JUNE 1953

PRECISION METAL MOLDING

INCLUDING DIE CASTINGS MAGAZINE

DIE CASTINGS
INVESTMENT CASTINGS
POWDER METALLURGY
PERMANENT MOLD CASTINGS
PLASTER MOLD CASTINGS
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PMM

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. . . see why leading die-casters choose CAST-MASTER

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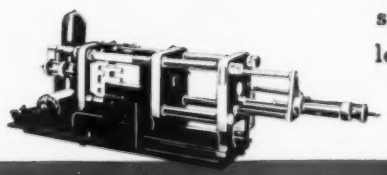

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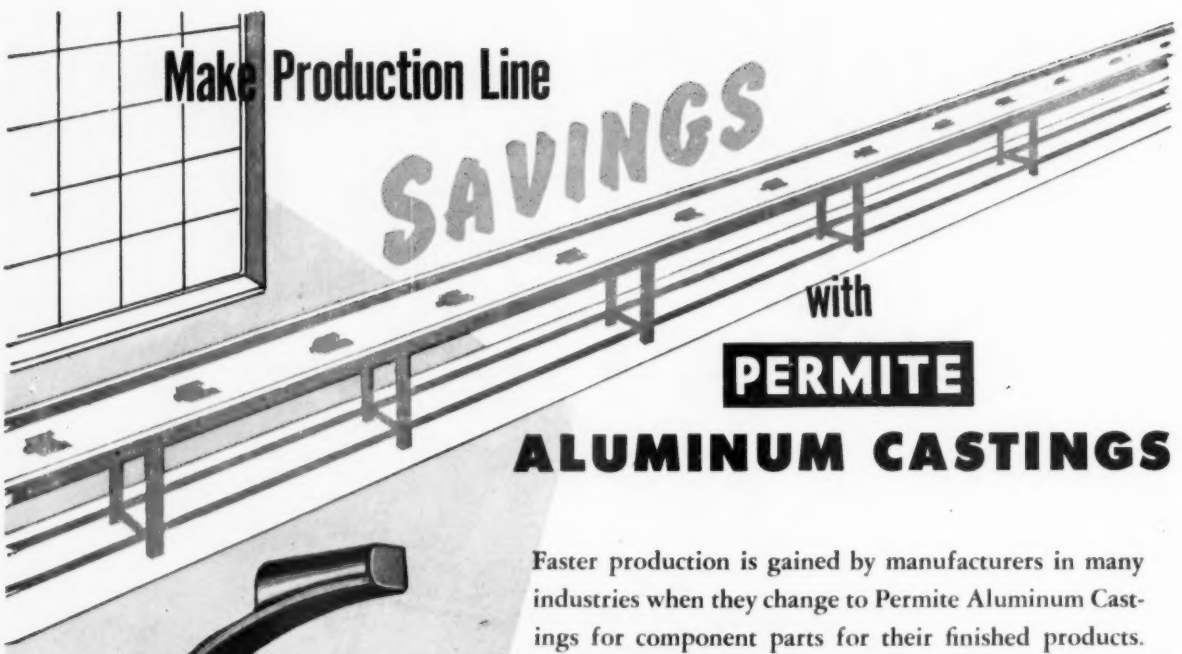
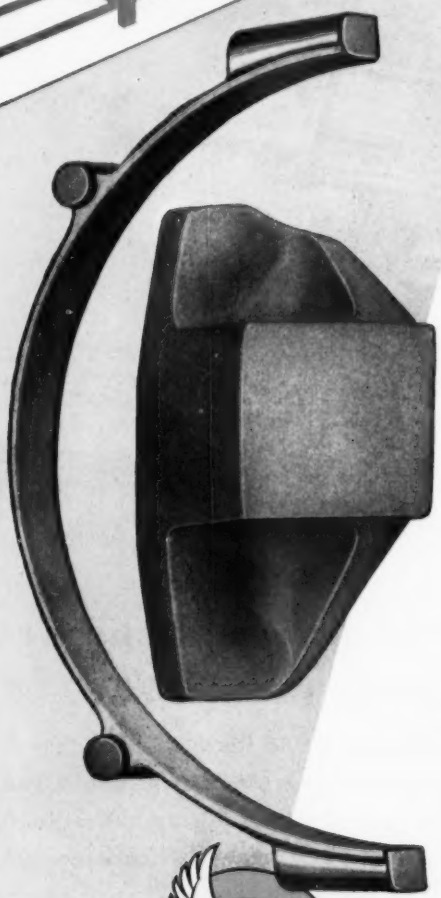
Make Production Line SAVINGS with PERMITE ALUMINUM CASTINGS





Faster production is gained by manufacturers in many industries when they change to Permite Aluminum Castings for component parts for their finished products. Light-weight Permite Aluminum Castings bring easier, faster handling on the assembly line. Permite users receive castings of uniform quality, thus avoiding interruptions caused by defective or substandard parts. Deliveries, too, are always on schedule; parts are on hand when needed.

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JUNE 1953
Vol. 11 No. 6

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PRECISION METAL MOLDING

DIE CASTINGS • INVESTMENT CASTINGS • POWDER METALLURGY
PERMANENT MOLD CASTINGS • PLASTER MOLD CASTINGS

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Published monthly by the TECHNICAL PUBLISHING COMPANY, an affiliate of INDUSTRIAL PUBLISHING COMPANY, publishers of APPLIED HYDRAULICS, FLOW, INDUSTRY & WELDING, OCCUPATIONAL HAZARDS, COMMERCIAL REFRIGERATION AND AIR CONDITIONING. Member Controlled Circulation Audit, Inc. Not responsible for unsolicited editorial material. Indexed regularly by Engineering Index, Inc.

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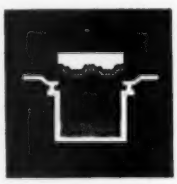
Published monthly. Acceptance under Section 34.64 P. L. & R. authorized at Marion, Indiana.

NEW general-purpose shell gives greater latitude

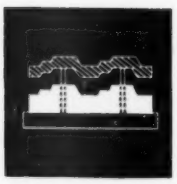
Bakelite Company announces the development of a new general-purpose shell molding resin that *can be subjected to a greater variation in operating conditions than ordinary shell molding resins.*

Shell molds bonded with this resin reach minimum usable strength in the curing operation faster than molds made with ordinary resins. They also retain their strength for longer periods at curing temperatures, permitting greater leeway in curing time.



This new BAKELITE phenolic resin reduces the tendency of the resin-sand mixture to fall off the pattern plate during the inverting operation.

Shell molds made with this new resin resist the tendency to distort upon ejection from the hot pattern plate, insuring better mating of mold halves. This hot rigidity is obtained without sacrificing toughness

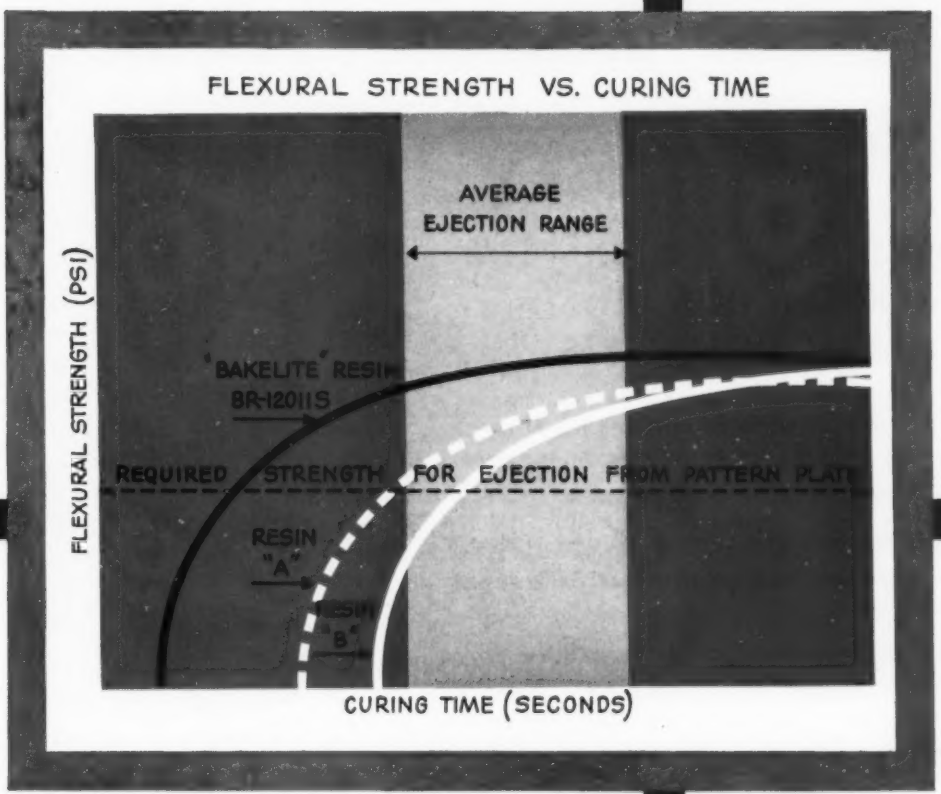


and provides molds that are more dimensionally stable, and which resist deformation during the pouring operation.

Field and laboratory tests of molds made with BAKELITE phenolic resins reveal a direct correlation between resin particle size and mold strength. In common with other BAKELITE phenolic shell molding resins, the new resin is finely ground, and is uniform both as to particle size and batch-to-batch production. The fine uniform particles give greater coverage per pound of resin. Smaller quantities of resin are needed to reach minimum usable strength, with resulting economies. This uniformity also eliminates the need for foundrymen to make extensive adjustments in formulation during production operations.

Your foundry department or supplier will be interested in this new shell molding development. Bakelite Company engineers, located in principal cities, can provide expert guidance in the use of phenolic resins. For the basic story on shell molding and the BAKELITE Resins developed for it, write Dept. QI-60.

molding resin in mold-making



BAKELITE Resin BR-12011S is resistant to distortion upon ejection from the hot pattern plate because of its high flexural strength when hot. Shell molds produced with this material will reach a minimum usable strength faster than ordinary shell molding resins, and will retain a strength in excess of this minimum for longer periods while still at curing temperatures.

BAKELITE
TRADE-MARK
RESINS FOR SHELL MOLDING

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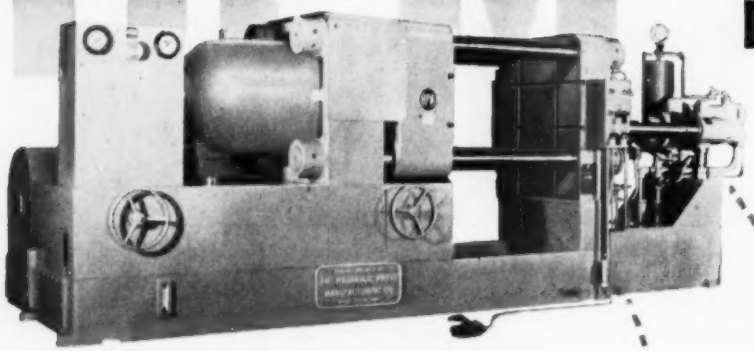
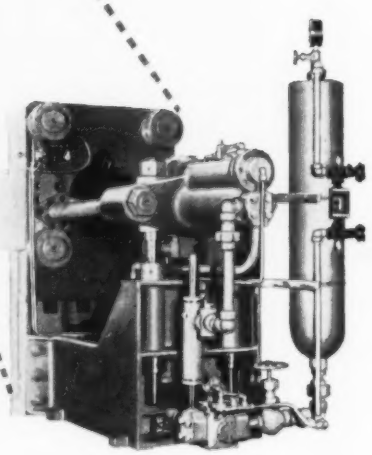


Model 400-B *Aluminum* Die Caster!

with Built-In Nitrogen Accumulator for INCREASED INJECTION SPEED!

for ALL-HYDRAULIC HIGH PRODUCTION of PRECISION PARTS . . .

- Here's a new, high-speed die casting machine for making aluminum castings up to 12 lbs. in weight. Listed below are just a few of the H-P-M design features which make this new die caster second to none:
- High-speed plunger advance . . . up to 400 ft. per minute.
- Positive, injection pressure build-up . . . no pre-fill valve to close.
- Built-in hydraulic ejector saves time, greatly reduces die costs and minimizes operator fatigue.
- Rugged straight-line "All-Hydraulic" die clamp with few moving parts, assure positive die alignment . . . die change-over is simple and fast.
- Dual hydro-electric safety devices guard against premature injection.
- Plenty of space around die mounting surfaces for installation of core pull cylinders.
- Independent handwheel adjustments for both die clamp and injection pressures.



400 ft. per Minute *Injection Speed*

Write for catalog 5106-A, today.

SPECIFICATIONS MODEL 400-B					
SIZE OF DIE PLATES	SPACE BETWEEN BARS	DIE OPENS	MAXIMUM DIE SPACE	CAPACITY PER SHOT (LBS.)	NET WT. (LBS.)
38"x38"	23"x23"	16"	42"	2.2 To 12.2 (Al)*	40,500

*Note: The model 400-B handles brass and magnesium die casting as well. Complete specifications on this and model 150-A (150-Ton) machines on request.

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1094 Marion Road, Mount Gilead, Ohio, U.S.A.

Presses For Every Pressure Processing Application

For additional information Circle No. 17 on the Reader Service Card

Turn back the pages of history to the early 19th century. There was no Marshalltown . . . not even an Iowa. Just a barren plain which dwarfed the tiny settlements dotting its landscape. Favored hunting grounds for a nomadic Indian tribe . . . the Kiowa . . . and their chief, Apiatan. Following the buffalo in quest of food and shelter, the Kiowa often wandered into the Iowa territory from their home on the banks of the north Platte River.

Apiatan wouldn't recognize the prairie of today! Sprawling cities have replaced the tiny settlements. The bow and arrow has bowed to the modern-day tools of the hunt. Machine-made strips of stone and asphalt cover the dusty paths that were once the product of his hoofbeats.

Kiowa Corporation has changed, too! From a modest brass foundry in 1927 to Kiowa's present three divisions . . .capable of producing 100,000 pounds of castings daily. One of the great Midwest's leading suppliers of non-ferrous castings. More than a quarter century of industrial growth and progress!

OVER A QUARTER CENTURY IN CASTINGS

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• Brass, Bronze, Aluminum Sand Castings

KIOWA CORPORATION
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. . . to get complex parts like these

Whatever you make, it will pay you to investigate the complete Newton-New Haven service — from design to finished part.

Here's basic die casting data for every engineer and designer. Write on your company letterhead for your copy.

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LETTERS TO THE EDITOR

REPRINTS OF TEARSHEETS

We have been reading with interest several articles in your magazine and would appreciate 6 reprints or tear sheets of the following article: "Sinterings in business machines", issue of December, 1952, pages 45-46, 74-76.

As we will be asking you from time to time for reprints, we would like you to tell us the standard charges for reprints so that we can send cash or checks with our order in order to eliminate a lot of bookkeeping, auditing, etc. — H. G. (Methods and Equipment).

Tear sheets have been forwarded. We are always pleased to send tear sheets and, when available, reprints, of any articles appearing in PMM as long as our supply lasts. There is no charge for this service. — Ed.

LIST OF PATTERN MAKERS

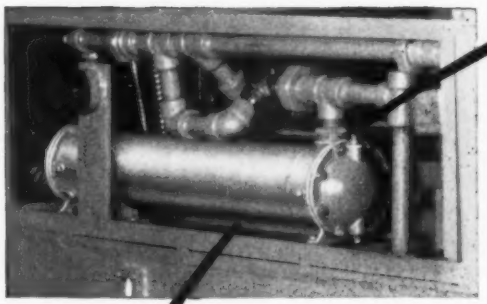
Please send us a list of pattern makers or mold makers in the Eeastern United States, especially Pennsylvania, New York and Ohio, who are in a position to build molds for our permanent mold machine.

— J. M.

We do not have available a list of mold makers in the Eastern United States. However, the U. S. Department of Commerce has recently published a directory of tool and die manufacturers in the entire United States. This "Directory of Independent Tool and Die Manufacturers" is a 37-page book available by writing Department of Commerce, Division of Printing Services, Distribution Section, Washington 25, D. C. It costs $.25. — Ed.

continued on page 10

For hydraulic fluid temperature safety in this H-P-M die casting machine



IT'S ROSS EXCHANGER EQUIPPED

Applying die clamping pressures up to 400 tons at top capacity and producing aluminum alloy castings weighing up to 12.2 lbs., this H-P-M Die Casting Machine is reportedly "putting the squeeze" on production costs.

. . . and one of the ways it's doing it is by holding hydraulic fluid temperatures in check. No lost capacity through pump slippage on *this* machine! A built-in Ross Type BCF Exchanger is furnished for just that purpose. Overheating is effectively prevented. Productivity is insured!

Like H-P-M, a user of Ross Exchangers on many of its products, so are *most* progressive machinery manufacturers furnishing this same, reliable, temperature-safeguard.

Their reasons . . . *summed up:* Ruggedness that withstands hydraulic shock — tough, ductile, seamless copper shell and brass forgings that can *take* the extra load. Compactness. A wide range of pre-engineered, fully standardized designs and sizes to meet most requirements.

More facts are in Bulletin 1.1K5. Write for your copy.

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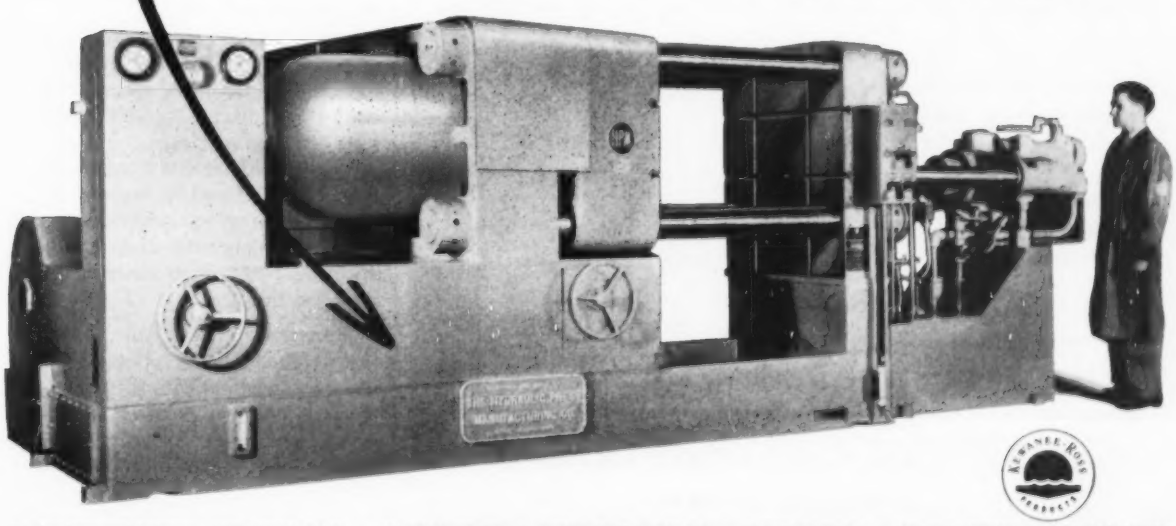
ROSS
EXCHANGERS



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--From Start to Finish

Our Facilities Are Complete For

ZINC - ALUMINUM - LEAD DIE CASTING

Here—at ***FORT DIE CASTING,*** production of quality die castings, at lowest cost, is made possible through the completeness of our organization and superb equipment, in our fully modern 100,000 square foot plant.

ENGINEERING: We maintain a competent Engineering Department to assure good casting design, the proper types of metals and methods to be used, and for close co-operation with our clients.

TOOL and DIE: We maintain complete tool and die making facilities. In this department, staffed by skilled technicians, we are equipped to completely tool up for your program and manufacture the dies to meet your specifications.

DIE CASTING: We maintain large batteries of modern die casting machines to meet all size requirements, plus special machines for die casting aluminum and lead. Expert metallurgical control is assured for the proper choice of alloys.

MACHINING: We maintain an unusually complete Machining Department. For these important and cost-saving operations, we design and manufacture new labor-saving jigs and fixtures for use in our large batteries of presses and other machining equipment, and when necessary, we design and build special purpose machines.

PLATING and FINISHING: We maintain complete facilities for mechanical finishes such as, burnishing, buffing and polishing; plating and finishing processes such as, chemical treatments, electrolytic coatings and painting.

Yes—you'll get ***Action*** with ***Accuracy,*** from ***Start*** to ***Finish*** at ***FORT***—and insure the proper and most economical production for your die cast products. We invite your inquiries.

TRADE FORT MARK

FORT DIE CASTING CORP.

MARYSVILLE, MICHIGAN

For additional information Circle No. 38 on the Reader Service Card

LETTERS TO THE EDITOR
continued from page 8

POROUS BRONZE SHEETS

We would appreciate your sending us the name of the supplier of sheets of porous bronze impregnated with oil. This was noted in Precision Metal Molding, January 1953 issue, in a very interesting article by Charles Fillinger. — P. W.

Information forwarded—Ed.

SHELL MOLDING SOURCE

We have been referred to you for information concerning shell molding.

We would appreciate the name and address of anyone in this area (Chicago) whom we could contact in regard to shell molding our product. We would appreciate a response so that we may take action on this matter immediately. — W. P. M. (Sales Manager).

The number of companies actively engaged in shell mold casting is quite limited at the moment, although more and more are entering this field every day. We have sent the names of companies in the mid-western area whom we know to be producing castings by this method. — Ed.

SOUND FILMS

We have noted on Page 6 of the May 1953 issue of Precision Metal Molding Magazine that two sound films are available on die casting.

We would be very much interested in showing these films to our employees and will appreciate receiving the names and addresses from whom they may be obtained. — J. W. M.

Sources of these two excellent films have been forwarded, along with sources of sound films on powder metallurgy and investment casting which are available without charge. — Ed.

continued on page 12

Aircraft engine heat deflector

Cream separator bowl base

...ON THE FARM

...stainless castings cut costs

Considerable savings in both material and machining time are effected when Crucible Stainless Steel Sand Castings are used. And here are two good examples.

The heat deflector — which protects vital turbine assembly parts in an advanced model aircraft engine — was cast by Crucible from AMS-5363A (Type 347) stainless . . . in conformance with rigid aircraft quality standards. Previously this part had been completely machined from a solid forging. The cast part performs the same job, but at a substantial saving in manufacturing cost.

The bowl base for a dairy cream separator was cast by Crucible from CF-20 (Type 302) stainless. To permit fast and efficient finishing in automatic machine tools, the casting must be held to close tolerances. Also, it has to be free from porosity, shrinkage, gas holes, inclusions or any defects that in the finished part would interfere with cleanliness or violate food laws.

Both the heat deflector and the bowl base applications exemplify how steel and machining time may be saved by using a stainless steel casting instead of machining from bar stock or a forging. If you make a product that must resist corrosion, consult Crucible regarding the advantages of producing it from a stainless sand casting.

CRUCIBLE first name in special purpose steels

53 years of Fine steelmaking

STAINLESS CASTINGS

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STAINLESS • REX HIGH SPEED • TOOL • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS

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A pressure cast mold made of
BERYLCO BERYLLIUM COPPER

Why is Berylco beryllium copper unsurpassed as a material for cast molds?

First of all, the castability of Berylco either reduces the need for machining or eliminates it entirely. Second, its impact strength and wear resistance make possible long production runs. Third, it can be hardened by a simple low-temperature heat treatment. These are cost-saving advantages as well.

Take pressure castings, such as the force for a camera body shown here. Under pressure, Berylco forms an unusually dense structure, with good compressive strength and smooth surface. Since as many as 150 molds may be reproduced from a single hob, you can get multiple cavities exactly alike at low cost. There is no danger of breaking fragile hobs, and cavities broken in production can be cheaply replaced. You can easily reproduce intricate detail, thin sections, irregular parting lines and raised letters or numerals. Furthermore, Berylco pressure castings can be surface finished by liquid honing, require no expensive machining. Tolerances can be held to 0.004 in. per in.

Add to this the increased thermal conductivity of Berylco. No wonder it is being used more and more in the injection molding of novelty, plastic and industrial parts!

Though we do not supply pressure cast molds, we furnish Berylco ingots to mold makers throughout the world. Plan now to increase your range of alloys; send for your trial order today. Send also for your free copy of the recently published Product Directory. It contains the most complete listing of available forms of beryllium copper.

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LETTERS TO THE EDITOR
continued from page 10

ANNUAL DIRECTORY

I would appreciate your sending me a tear sheet of your alphabetical listing of fabricators, equipment manufacturers and powder suppliers, as it appeared in the April 1953 issue of "Precison Metal Moldng". — F. S. (Director of Purchases).

There have been many requests for extra copies of our annual directory of the powder metallurgy industry. Some purchasing departments have asked for several for various individuals. They are available without charge as long as our supply holds out. — Ed.

LOOKING FOR A SOURCE

We are looking for a source for quantities of wheels we need for imprinting pencils.

They should have raised letters around the periphery which are about ⅛ inch large. Could you suggest anyone we could contact? — V. W. (Manager).

Wheels of this type could be made to your specifications if there is a large enough quantity to justify tooling costs. Some manufacturer may have imprinting wheels of this type available from stock, but we don't have any list of such sources. If any PMM readers are interested, we will be pleased to put them in touch with Mr. V. W. — Ed.

VACUUM PLATING EQUIPMENT

Could you supply me the name of a manufacturer or supplier that sells vacuum plating equipment? I am interested mainly in a small apparatus that could be operated under a large bell jar and would consist of a vacuum pump and some sort of heating unit. — W. A. S.

Information forwarded.—Ed

ALL SHAPES...ALL SIZES

...ALL LOW COST

Check with us on cutting piece-costs . . . making two or more parts as one . . . reducing machining operations. We've got the equipment to get the most out of the high-speed, flexible die-casting process . . . much of it of our own design. Many leading manufacturers have found that we can give them highest quality parts at the lowest cost. Send prints or samples for quotation—engineering advice at no obligation. Brochures on request. *Dollin Corporation, 614 So. 21st St., Irvington, N. J.*

DOLLIN

Zinc & Aluminum

DIE-CASTINGS

Sales Offices: Boston • Buffalo • Canton • Chicago • Detroit • Philadelphia • Pittsburgh • St. Louis • St. Paul

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When Pressure replaced Gravity
DIE CASTING WAS BORN

Early Die Casting Machine in Operation

The production of castings by pouring molten metal into sand molds is an ancient art. The jewelry industry's requirements for smoother castings with sharper outlines, resulted in the development of a process utilizing plaster molds. In either case, however, the removal of the cast part necessitated the destruction of the mold. The search for a permanent mold for the quantity production of repetitive parts bore fruit in the Middle Ages when manufacturers of pewterware developed molds made of iron. In the 1800's so-called tin soldiers were also gravity-cast from hinged iron molds.

The next logical step was to improve the accuracy of cast parts by forcing molten metal under pressure into strong steel molds, instead of merely relying on gravity. This eventually led to the development of the linotype machine by Ottmar Mergenthaler. The basic principle of the linotype machine — pumping metal into a permanent mold by means of a plunger submerged in liquid metal — was adapted and embodied in the first die casting machine at the start of the century, and the first commercial die castings, such as automotive bearings, were produced from tin and lead-base alloys.

When early die casting experimenters — called upon for castings with better mechanical properties — turned to zinc as a base metal, little did they realize that zinc base die castings would finally advance to a point where they became a vital factor in modern engineering processing. Least of all would these pioneer die casters have foreseen that in a relatively short span of years their infant-industry would be outranked only by the galvanizing industry as the country's largest consumer of zinc.

EASTERN SALES AGENTS ST. JOSEPH LEAD COMPANY 250 PARK AVENUE, NEW YORK 17
BUNKER HILL 99.99+% ZINC
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● Many of America's leading manufacturers, producing a wide variety of products, are benefiting from Auto-Lite die cast research, experience and advancement. Such developments as high pressure casting, special alloying practices and improved quality through the "controlled metals process" make Auto-Lite the logical source of supply for precision die castings. Address inquiries to:

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Are Products Produced From Correctly Made PMD Dies

DIE CASTING DIES

(The die above shows on the left the upper section and on the right the lower section is shown assembled with cavities and gating.)

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To insure the adherence to dimensions and maintenance of standards for products manufactured in any of the ways shown above requires their production by the finest-made dies possible. PMD produces dies such as these because we have the "know-how", men with experience, and are equipped with the best of quality machine tools.

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Serving Industry throughout the United States and Canada, PMD Customers include: Major Manufacturers in the Aluminum, Appliance and Automotive Industries. Our staff of specialists is ready and able to meet your most exacting specifications for dies of the highest quality and most intricate structure.

A Complete Die Design Service Available
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Between the Lines

in this and future issues of PMM

— IF THE PORES of an iron or steel sintering are filled with copper alloy, the physical properties of the piece can be improved. This process, known as infiltration, is now widely used for producing the necessary high physical properties in jet compressor blades. An article by a man who has been closely associated with the development of this process begins on page 92 as a Special PMM Technical Report. He not only answers the questions: What is infiltration? and Why is it done? but also he discusses the technical aspects, influence of variables on properties, a tabulation of physical properties, and some conclusions concerning the uses of infiltration.

— SMALL SIZE die castings have certain special advantages in addition to those normally obtained by average sized die castings. What some of these advantages are is the subject of an article that begins on page 38.

— DIAL TELEPHONES use millions of small zinc alloy die castings and bronze sinterings. Sometimes there is a saving, but as often as not, the costs are of second importance to production facility. If you have ever tried to hold cumulative tolerances on an assembly of small brass stampings, you will understand these reasons, as set forth in an article beginning on page 44.

— WHAT HAPPENS when a powdered metal compact passes through a sintering furnace? How does the mass of powder particles attain some of the characteristics of wrought metal? What are the

continued on page 18

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Die Making • Metallurgical Control

Most Modern Die Casting Equipment

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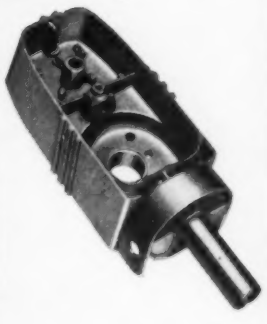

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Designers specified powdered metal for this two inch helical gear to avoid the high cost of production by conventional methods. But the combination of helical gear teeth with the axial elements of the clutch collar presented an unusual problem in powdered metal fabrication.

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continued from page 16

laws governing the sintering of powdered metal compacts? These are some of the questions that will be answered in an article scheduled for PMM this summer. It will be followed by a second article going into detail on sintering methods and equipment.

— THE THIN OXIDE FILM that forms instantly on aluminum is self-sealing and accounts for the corrosion resistance of untreated aluminum castings; it also accounts for part of the difficulty encountered in production electroplating of aluminum alloys. A discussion of the proven methods for finishing aluminum die castings begins in this issue on page 58. Written by a specialist in the field of finishing aluminum, the article covers the mechanical finishes such as barrel finishing and polishing, as well as plating, painting, chemical treatments and anodizing.

— CAN A PHOTOGRAPHIC process replace a metal casting process? An unusual machine which does this is the subject of an article which starts on page 40.

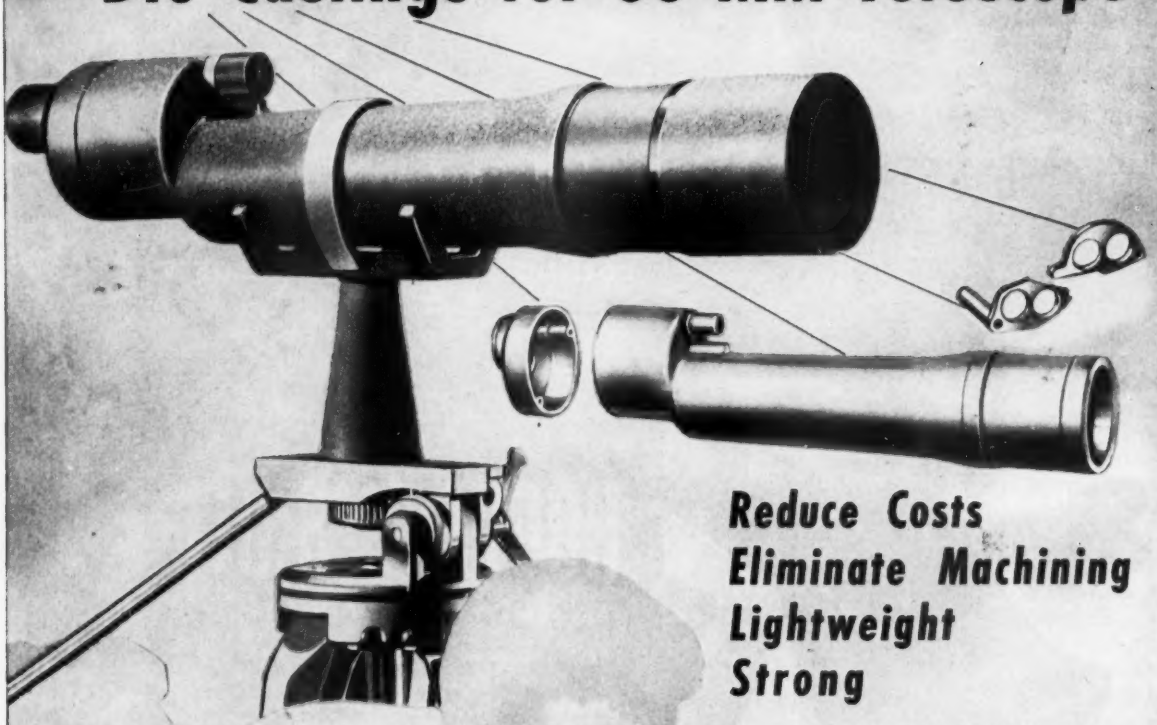
— DIE LUBRICATION will be discussed in detail in articles to be presented during the Summer and early Fall. The first of the series appeared last month devoted to the silicone lubricants; two others are scheduled on colloidal graphite and mineral base lubricants.

— "CUSTOM-TAILORED" physical properties are among the prime advantages of powder metallurgy. For instance, a company needing specific linear and volumetric expansion in material to use in mounting industrial diamonds get it by a blend of metal powders. Story starts on page 36.

Every casting here is cutting somebody's costs
Put
HOOVER'S SKILL
to work for you!
Hoover Die Castings like these save on material costs, save on weight, and save on labor, in operations where mass production and close tolerances are important.
Some of these castings are zinc, some aluminum. All are strong, and all—see for yourself—are good looking! Every casting here is the better for Hoover's many years of die-casting experience (since 1922!)... and for the skill of Hoover's veteran design engineers, X-ray and metallurgical experts, efficient and costwise production methods.
Perhaps Hoover Die Castings can cut costs or improve the sales appeal of YOUR product. Talk it over with a Hoover sales engineer. Also write for the new, informative booklet, "Hoover Die Castings." THE HOOVER COMPANY, Die Casting Division, North Canton, Ohio.
HOOVER
Specialists in the field of die castings

For additional information Circle No. 15 on the Reader Service Card

BAUSCH & LOMB selects PARKER Die Castings for 60 MM Telescope



Reduce Costs
Eliminate Machining
Lightweight
Strong

Bausch & Lomb, now celebrating its 100th anniversary, selects Parker as source for quality die castings. The product illustrated is the Bausch & Lomb BALscope Sr. 60 MM spotting scope in wide use as a shooter's spotting scope or, when mounted on a tripod, a telescope for astronomy, sports or bird watching. Parker Die Castings, component parts of this high precision scope, serve to reduce costs by elimination of machining operations. The parts are produced to rigid specifications . . . lightweight and strong.

Consult with Parker on your next die casting requirements. Your action will be mutually profitable.

and when you think of Die Castings THINK OF

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PARKER ALUMINUM *and* ZINC *Die Castings*

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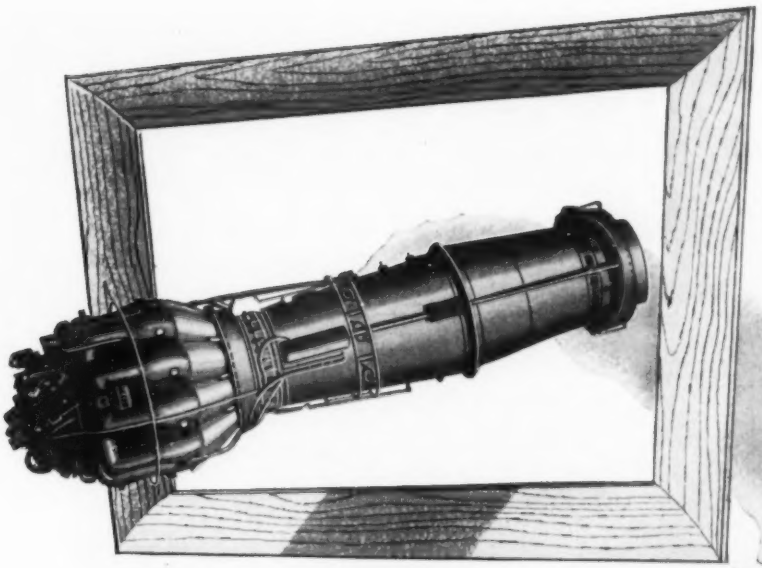

MERCASTINGS* fit YOUR design picture . . .

*FROZEN MERCURY INVESTMENT CASTING

● Do you ever feel that your creative engineering is hampered by limits imposed by traditional metal-working processes? Then investigate the production process that takes over where the others leave off! Learn about the greater design freedom and production economies available through mercastings by Alloy Precision.

With this advanced method, surface finishes can be cast from 125 to 60 micro-inches . . . dimensional tolerances can be held to $\pm .003''$/inch. These, of course, depend on mass and material. *In many applications, mercastings require no machining.*

Frozen mercury patterns melt out of the mold permitting one-piece castings of amazingly complex contours and interior cavities. Thus, what would otherwise be an assembly of machined parts, can often be mercast as a unit.

Production runs in hard-to-machine or non-forgeable metals are routine at Alloy. Now, at last, you can select materials by product requirements rather than machining limitations.

A-0615

Send design prints of your mass production parts that are:

1. too difficult or too expensive to machine
2. too large or too intricate for lost wax casting

Our metallurgists and mercasting engineers will welcome the opportunity to assist you.

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No Problem's Too Tough

when you call in ... PRECISION

LARGE CASTINGS

Precision's ability to produce large die castings offers you these specific advantages—

- Makes possible the use of die castings which, if produced by other methods, would cost considerably more.
- By proper design, large die castings can be made stronger and more rigid than the same part produced by other methods.
- Large die castings can be produced combining several smaller parts, thus reducing or eliminating assembly costs.

Since 1909 the name "PRECISION" has been the symbol of highest quality in the die casting industry.

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in this business we never stop learning

METAL POWDER PARTS BY MORAINE

While we've had a large amount of experience (over a quarter century) in making *billions* of metal powder parts, there seems to be no limit to our learning. Always there is something new to learn, something valuable to add to our already vast store of knowledge on the subject of powder metallurgy.

We find new ways to improve the physical properties of our metal powder parts; we see a constant broadening in the range of materials we can offer our customers; and the number of applications for our metal powder parts grows with our knowledge.

We're proud of the position we've reached in the field of powder metallurgy . . . but no prouder than we are of the way our products are able to serve industry by improving performance while cutting costs.

m

moraine products

DIVISION OF GENERAL MOTORS CORPORATION, DAYTON, OHIO

WHY ALDRICH PUMPS CUT FIRE RISKS

● It's simple. With Aldrich Pumps *water* can be used as hydraulic medium, as well as oil. With water, you eliminate chances of plant damage or injuries due to oil fire.

Fire "insurance" like this is important. But so are the many other advantages you'll get when you specify Aldrich Pumps. Here are a few of them:

MORE POWER

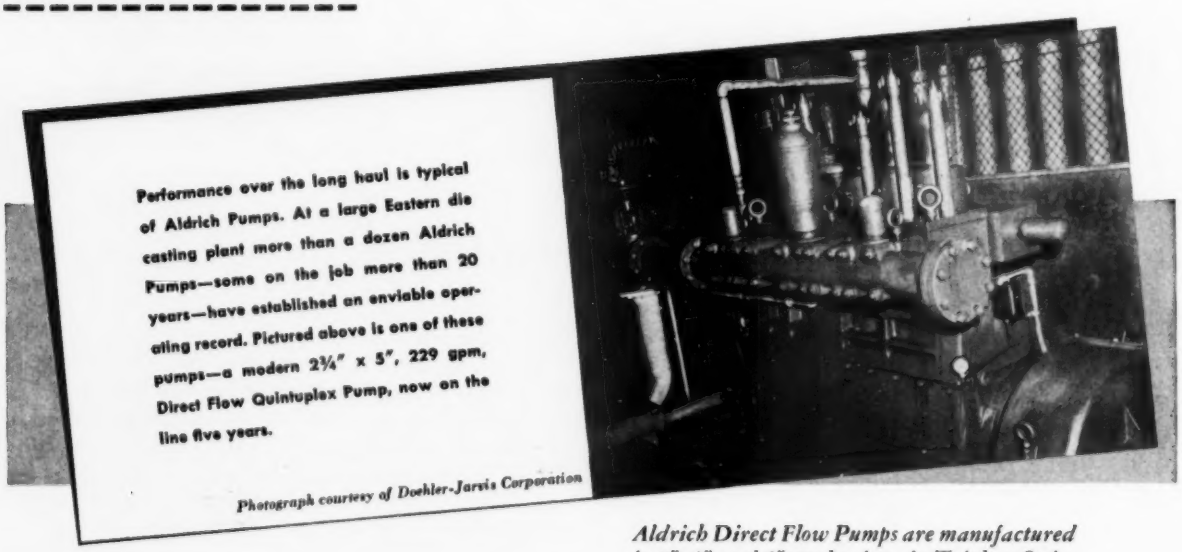
Higher operating speeds afford greater *volumes* and *pressures* from smaller, more compact pumps.

SIMPLE MAINTENANCE

Fluid ends are sectionalized . . . parts can be replaced easily and at low cost. To facilitate changes in pressure and volume requirements, *plunger sizes are easily changeable* . . . in most cases changing them is simply a matter of using new glands, throat bushings and packing in the same fluid end. And, *wearing parts are interchangeable* . . . helping to reduce spare parts costs and inventories particularly when combinations of multiplex pumps are employed.

These are *all* good reasons why Aldrich Pumps have proven their worth over the years with many die casting manufacturers. They are good reasons, too, why you should get more information about Aldrich Pumps.

Write us for catalogs, engineering service, or a representative's call. We invite your inquiries for pumps or complete central hydraulic systems.



Performance over the long haul is typical of Aldrich Pumps. At a large Eastern die casting plant more than a dozen Aldrich Pumps—some on the job more than 20 years—have established an enviable operating record. Pictured above is one of these pumps—a modern 2¾" x 5", 229 gpm, Direct Flow Quintuplex Pump, now on the line five years.

Photograph courtesy of Doehler-Jarvis Corporation

Aldrich Direct Flow Pumps are manufactured in 3", 5" and 6" stroke sizes, in Triplex, Quintuplex or Septuplex models (50 to 900 hp).

THE ALDRICH PUMP COMPANY

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Representatives: Birmingham • Bolivar, N. Y. • Boston • Buffalo • Chicago • Cincinnati • Cleveland • Denver • Detroit Duluth • Houston • Jacksonville • Los Angeles • New York • Omaha • Philadelphia • Pittsburgh • Portland, Ore. Richmond, Va. • St. Louis • San Francisco • Seattle • Spokane, Wash. • Syracuse • Tulsa

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DIE CASTING–

for products that call for sturdiness plus elegance ...at moderate manufacturing costs

CASE HISTORIES FROM MT. VERNON FILES

You can appreciate the four outstanding characteristics of this Brumberger product within a minute of seeing it:

(1) attractive appearance

(2) luxurious feel

(3) sturdiness

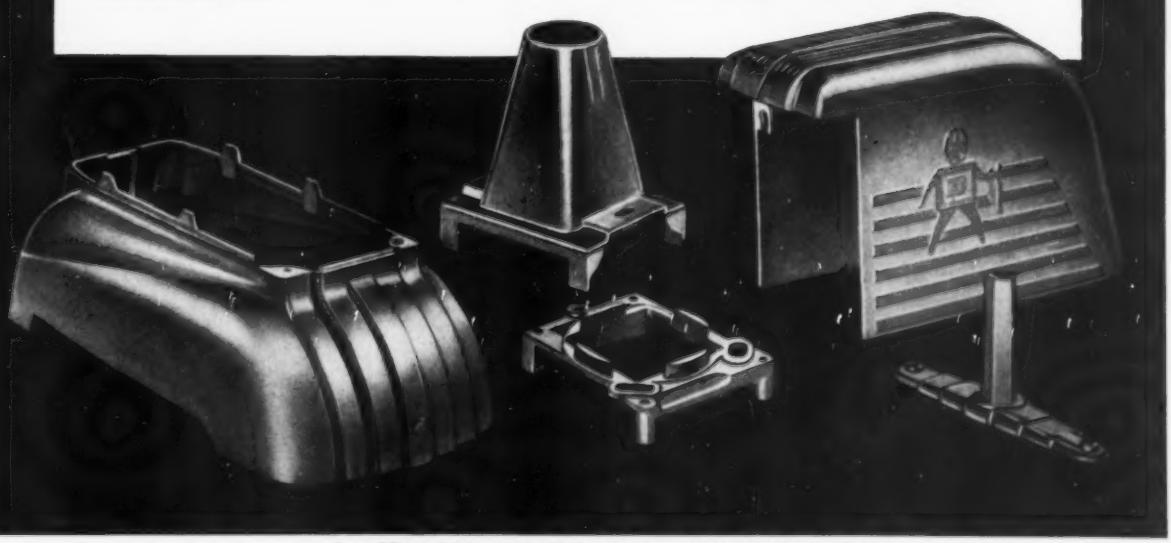
(4) extremely light weight

In time past, the Brumberger Company, of Brooklyn, N. Y., was accustomed to stamp all the parts of its photographic products from sheet steel, but today all units for the Deluxe Slide Projector are die cast.

Says Brumberger: "For an item such as our new 300-watt slide projector, which is styled to please the eye with gracefully curved surfaces and flowing lines, and engineered to give a lifetime of service, die casting is the supremely advantageous method of manufacture. Not only do we obtain a very good looking, lightweight, high-performance product, but the speed and economy inherent in the die casting process helps to hold down our manufacturing costs."

Perhaps you, too, have a product that requires to be both sturdy and elegant; or, perhaps the emphasis rests on only one of these attributes. However it may be, you'll profit by considering Mount Vernon die casting. Whether your specifications be simple or complex, we feel confident we can show you the way to economical output of quality merchandise.

MT. VERNON
DIE CASTING CORP.
MT. VERNON NEW YORK



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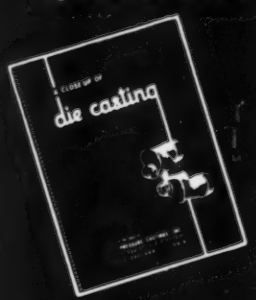
The fact that we continue to serve the country's leading manufacturers ... year after year ... proves that Pressure is a good outfit to do business with!



This booklet brings our organization to you, in words and pictures, and tells how better die castings are made. Write for your copy today!

PRESSURE CASTINGS, INC.

die castings

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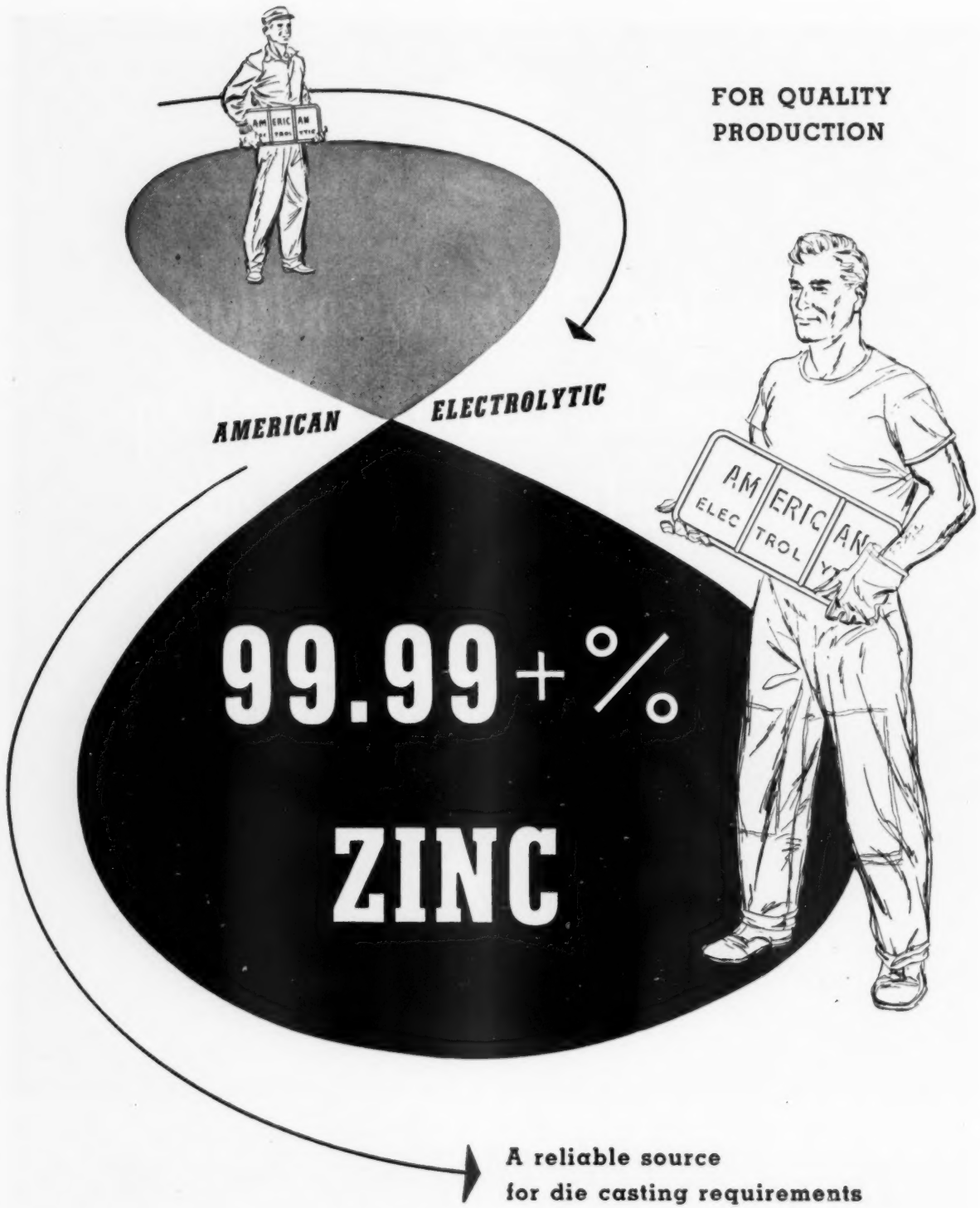

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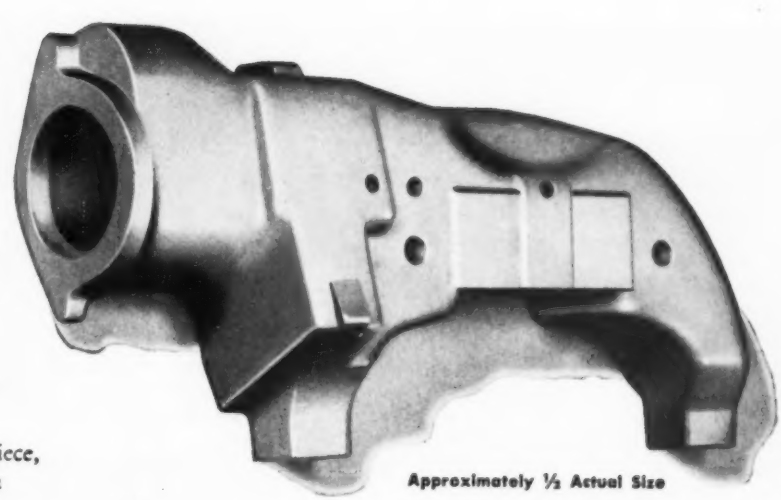
A Master Design Formula

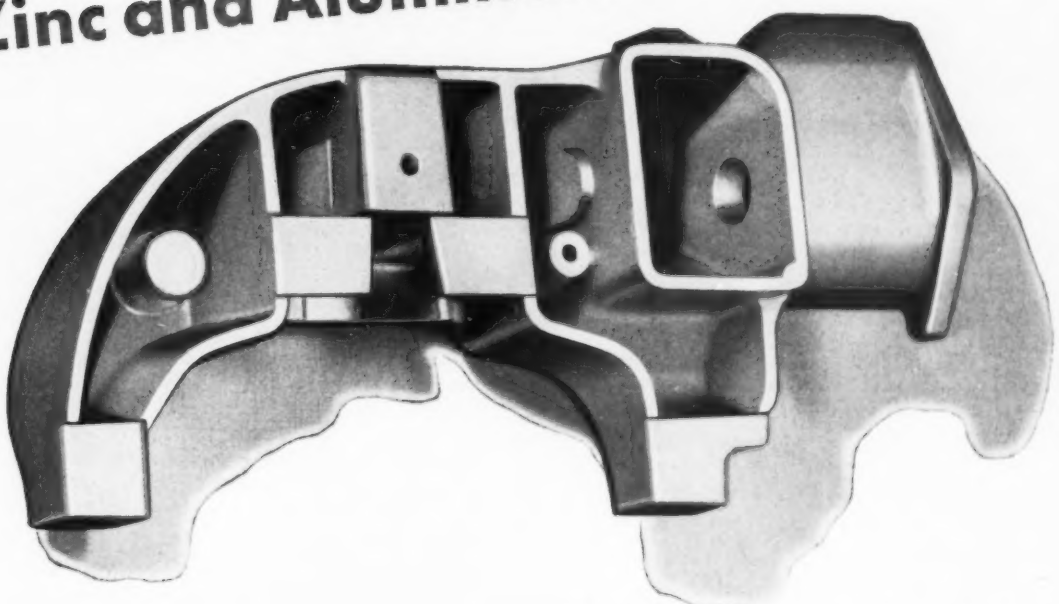


Approximately ½ Actual Size

Consolidate functions in one piece, combine light metal lines with high strength and provide pleasing appearance with high production potentials — with Madison-Kipp Zinc and Aluminum Die Castings

MADISON - KIPP

Zinc and Aluminum Die Castings



Designers are becoming more and more conscious of the advantages of the high pressure die casting process. They can believe established facts as illustrated here. They can duplicate these favorable economic results in their own designing. Madison-Kipp is skilled and seasoned in die casting mechanics and invites your inquiries for co-operative effort.

kipp

MADISON - KIPP CORPORATION

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• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

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THE PLACE: RANGERS DIE CASTING COMPANY, Lynwood, California

THE STORY:

Soaked in PYDRAUL . . . Not in Flames

Die-cast products of several kinds are made on the 8 machines in this shop. Two weeks after switching from conventional hydraulic fluid to Monsanto *Pydraul*—and unknown to the operator of a cold-chamber aluminum die-casting machine—an electrical circuit failed.

Operator continued to run the machine until the nitrogen in the accumulator unloaded into the oil reservoir, blowing *Pydraul*, which is fire-resistant, twenty feet into the air—all over the machine, operator, helper, and directly into an open pot of molten aluminum.

THE POINT OF THE STORY:

"Instead of a flash fire and serious burns to several workmen, we suffered only to the extent of two fluid-soaked workers and 40 gallons of *Pydraul*." *Paul T. Harlow, President.*

How safe is the fluid in *your* hydraulic lines today? Without any alterations in equipment, the changeover to *Pydraul* can be made.

PYDRAUL is fire-resistant . . . noncorrosive . . . chemically stable . . . nonreactive . . . nonvolatile—does not evaporate.

SEND for this engineering report. Ask for "Pydraul F-9." Write Monsanto Chemical Company, Organic Chemicals Division, 800 North Twelfth Blvd., St. Louis 1, Missouri.

***Pydraul*: Reg. U. S. Pat. Off.**

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SCHULTZ

Specialists in Zinc Die Casting

Here are two of the production stages through which your zinc die castings will pass in their transition from raw material to finished product. Our alloying department has one aim — to exercise the utmost care in the preparation of the alloy to insure on-grade castings. Our complete design and engineering service will assist you to design your product for the Zinc die casting process.

Nearly A Quarter Of A Century Of Service — Exclusively Zinc Die Castings

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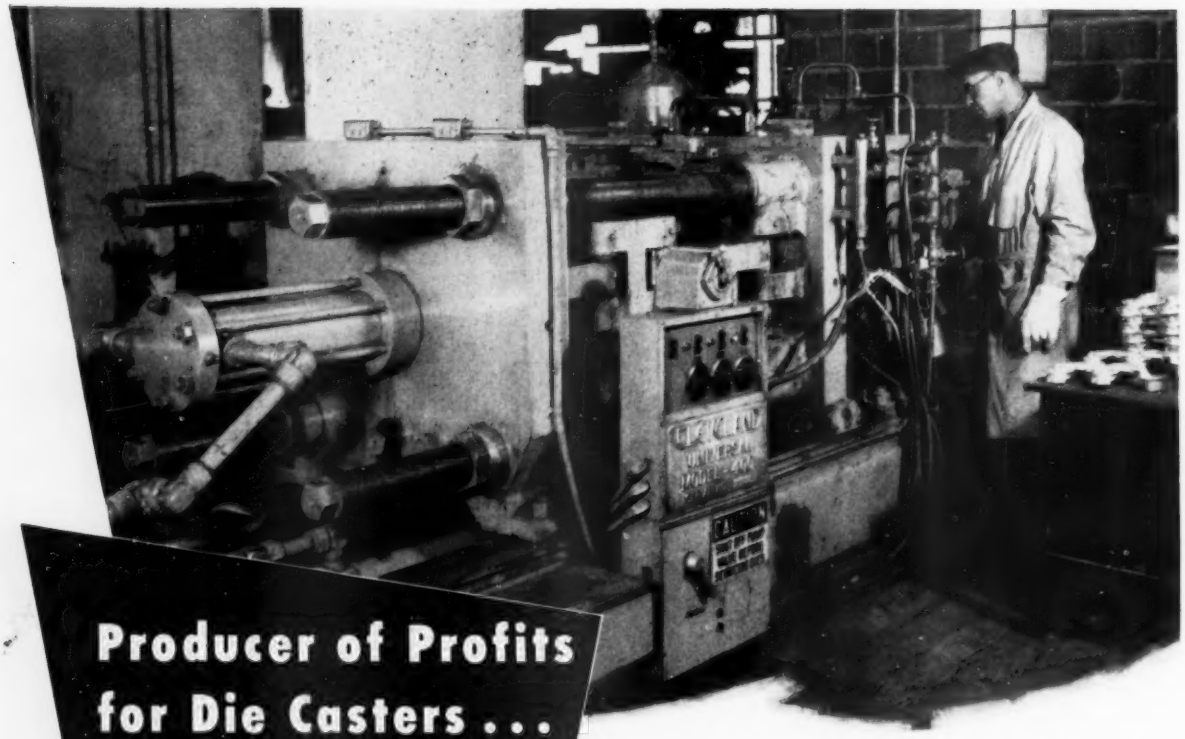

Producer of Profits for Die Casters . . .

Aluminum Burner Bases as cast in Clevelands

Photo at top of page shows one of two Cleveland Model 400 Die Casting Machines in operation at General Die Casting Company, Ferndale, Michigan. Among the many excellent parts produced by this prominent die caster is an aluminum burner base used by most leading gas range manufacturers. The burner bases are cast in a four-cavity die at the rate of 100 shots per hour. Weight of the shot is 2½ lbs. A gate of four castings and a finished part are shown above.

CLEVELAND model 400 die casting machines

Ask experienced die casters about Cleveland performance. They'll tell you these rugged, powerful machines can be depended upon to produce dense, *hardware finish* castings at a highly *profitable* rate of production.

Die casters like the ease with which Clevelands can be set up; the accessibility for changing dies, removing castings and machine maintenance. They like the simplicity and *safety* of operation; the fool-proof, automatic timing of the casting cycle. They like Cleveland's *universal* construction. Simply changing hot metal ends converts the machine from zinc to aluminum or magnesium casting . . . and any machinery handling crew can make the change *quickly*, without using special tools. That gives die casters all-around utilization of their machinery investment—and more profits for their shop.

Investigate Model 400 Clevelands for *your* die casting production . . . or Cleveland Models 200, 100 and 50, if your requirements call for machines of smaller capacities. Let a Cleveland engineer show you their advantages. For detailed machine information, write for bulletins.

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4952 Beech Street
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CLEVELAND • DETROIT
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Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

For additional information Circle No. 10 on the Reader Service Card

Examples of small castings, from a few ounces to 10½ lbs. in aluminum alloy aircraft and ordnance components... larger casting (black background) is a typical example of an Acme casting in aluminum alloy 195-T6, heat treated and aged.

ACME

CASTINGS

ALUMINUM AND MAGNESIUM

Engineered to meet the most exacting requirements

Yes—Acme aluminum and magnesium castings are engineered to meet the most exacting requirements for defense or civilian product applications. Light metal castings from a few ounces to hundreds of pounds are engineered and produced regularly for a growing list of customers.

Whether your present casting requirements are for ten or hundreds of thousands of a single design—we are interested in serving you.

Light metal castings, properly engineered and precision made, may give you both a greatly improved product and a saving in manufactured cost.

To get the full benefit of light metals requires expert knowledge from the design stage through the "test casting" stages, and in final production. Acme offers 32 years of engineering and foundry experience.

SEND BLUE PRINTS FOR ESTIMATES

PHONE
PROSPECT 6-5035

Consulting with Acme engineers may save you many headaches and dollars on production jobs. We welcome your requests for this service.

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ALUMINUM FOUNDRY CO.

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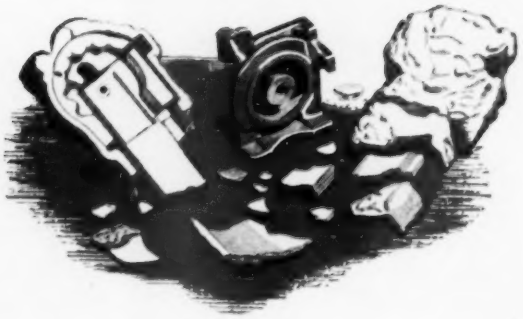


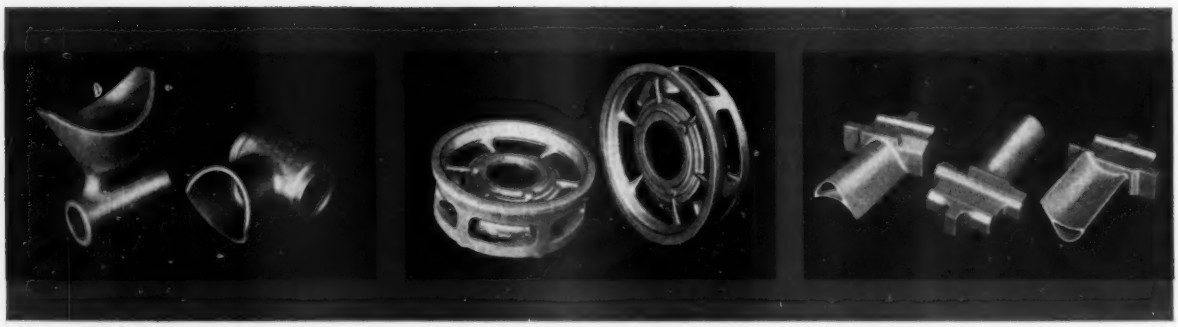
when a part can't be cast...

"INTRICAST" it

Ever figured out the formula and the curves for a part, then had to compromise with efficiency in order to come up with a design that *could* be produced in quantity at low cost?

That's the time to think of "Intricast" . . . an ingenious way to make patterns in frozen mercury that permit fast, high-finish castings of highest accuracy and intricate contour to be made on a production line.

The story of "Intricast" parts is too long and too dramatic to be told fully here . . . but write for our 8-page booklet MP-531 which gives all the details. A sales engineer can call at your convenience to help engineer "Intricast" parts into your products.



Metallurgical Products Division

Thompson Products, Inc.

CLEVELAND 17, OHIO

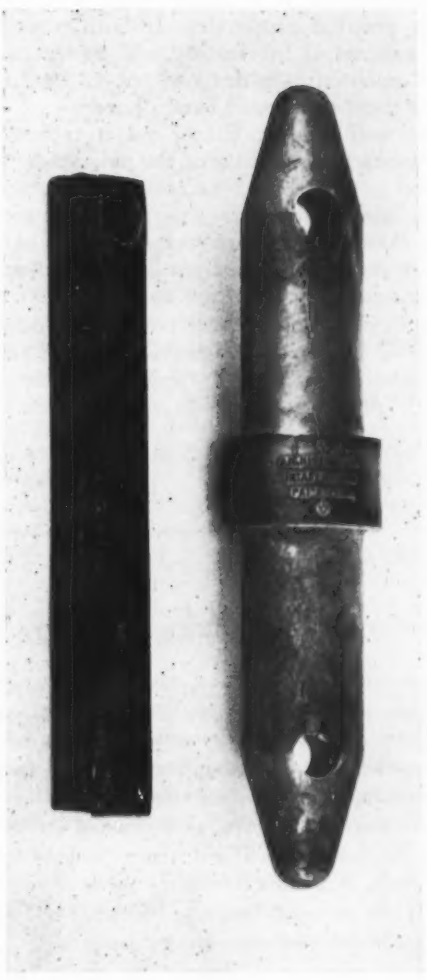
For additional information Circle No. 31 on the Reader Service Card

Use of steel insert gives DIE CASTING WITH A "BACKBONE"

A DIE CASTING WITH A BACKBONE? It is being done every day where designers want a component with the shape of a die casting and the strength of wrought steel.

It is common knowledge that ferrous alloys cannot be die cast successfully, but there is no reason why a steel bar cannot be encased in zinc or aluminum alloy die cast in almost any desired shape.

As an example, here is a use of reinforced aluminum die castings for the pins which join together the vertical members of pipe scaffolding.



Pipe scaffolding, such as that made by the Automatic Devices Co. of St. Louis, Mo., must be strong and rigid to provide safety for persons using it. It must also be corrosion resistant so that it has a reasonable life and can be assembled and disassembled easily and quickly.

One of the major points of trouble on the early types of scaffolding was the connecting pin used to join the vertical members together. As first designed, this pin was of steel and, since it was made from bar stock, required a considerable amount of machining.

In addition to the relatively high cost of the part, it had the disadvantage of corroding so that assembly and disassembly of the scaffolding became difficult and connecting pins had to be discarded after a short time in use.

The obvious material for this application is aluminum since any of the stainless steels are far too expensive for this application. On the other hand, aluminum bar stock, even heat-treated, is not strong enough to provide the safety factor essential for this job. The design finally worked out is a steel core piece totally enclosed in an aluminum die casting.

The steel core used and one of the finished

continued on page 84

A use of powder metallurgy TO CONTROL LINEAR AND VOLUMETRIC EXPANSION

ONE of the advantages of powder metallurgy that has been emphasized repeatedly is the ability to make unusual combinations of metals, or to make finished products having peculiar properties. In both cases, no other method of fabrication will do the same job. Cemented carbides and porous bearings are the most publicized examples.

Less well known, but of major industrial importance is the *ability of the powder metallurgists to compound mixtures of powders having linear and volumetric expansion properties that cannot be secured in any other manner*. At least they cannot be secured easily and economically by other methods.

The "cementing material" used to mount industrial diamonds in a metal holder is a use of powder metallurgy to secure specific expansion properties and do it economically.

Where powder metallurgy is the only way

Modern industry would slow down without powder metallurgy. Among the many products that only this process can make are: cemented carbides, heavy metal, self-lubricating bearings, metallic filters, certain fabricated forms of beryllium, titanium and zirconium, some electrical contacts, ceramets and ceramels, metallic friction materials and others. Without these contributions of powder metallurgy many of today's products and processes would be impossible and high speed production methods would be impaired.

Just what are the required properties of this cementing material?

- Linear expansion coefficient matching that of diamond.
- High thermal conductivity.
- Good adhesion to both diamond and metal (generally steel).
- Relatively low cost.

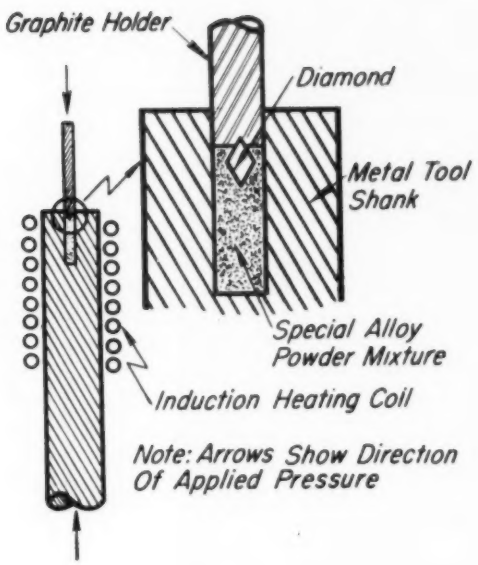
Just why each of these properties is important is worth examining rather closely.

Linear coefficient of expansion

In most industrial applications and particularly where a diamond is used to dress abrasive wheels, there is generated a very considerable amount of heat. This heat generation is highly localized, but may easily reach as high as 1000 F. If some metal such as copper nickel, cobalt, or some well-known alloy were used, it is probable that the coefficient of linear expansion would be in the range of $8x10^{-6}$ to $15x10^{-6}$ in./in./ deg. F. For diamond, over the same temperature range, the coefficient of linear expansion is about $0.9x10^{-6}$ in./in/ deg. F. With this great a difference, there would be a good chance that when the wheel dresser was in use, the greater expansion of the metal would allow loosening of the diamond with subsequent loss of the stone.

High thermal conductivity

Due to the excessive amount of heat generated at the point of contact between the diamond and the abrasive wheel, it is necessary to provide a means of rapid heat dissipation. This is accomplished by making the holder of relatively great mass and, since it is always a metal that has a high thermal conductivity. The "cementing material" between the diamond and the metal holder can, however, act



To mount an industrial diamond securely in the shank, a modified hot-pressing technique is used. A graphite holder positions the gem during the pressing and sintering operations.

as a thermal insulator if it is non-metallic. Such a condition would result in excessively high temperatures being generated within the stone and could result in cracking. Hence, this cementing material must be metallic and should have as high a thermal conductivity as it is possible to secure.

Good adhesion to diamond and metal

Regardless of how many desirable properties the "cementing material" may have, if it does not adhere to both the diamond and to the metal, there is a high degree of probability that the stone will pull out of the holder in use. Generally, the rough surface of the diamond is adequate to secure all of the necessary bonding with the "cement" so that the major problem is an adequate bond with the steel shank of the holder.

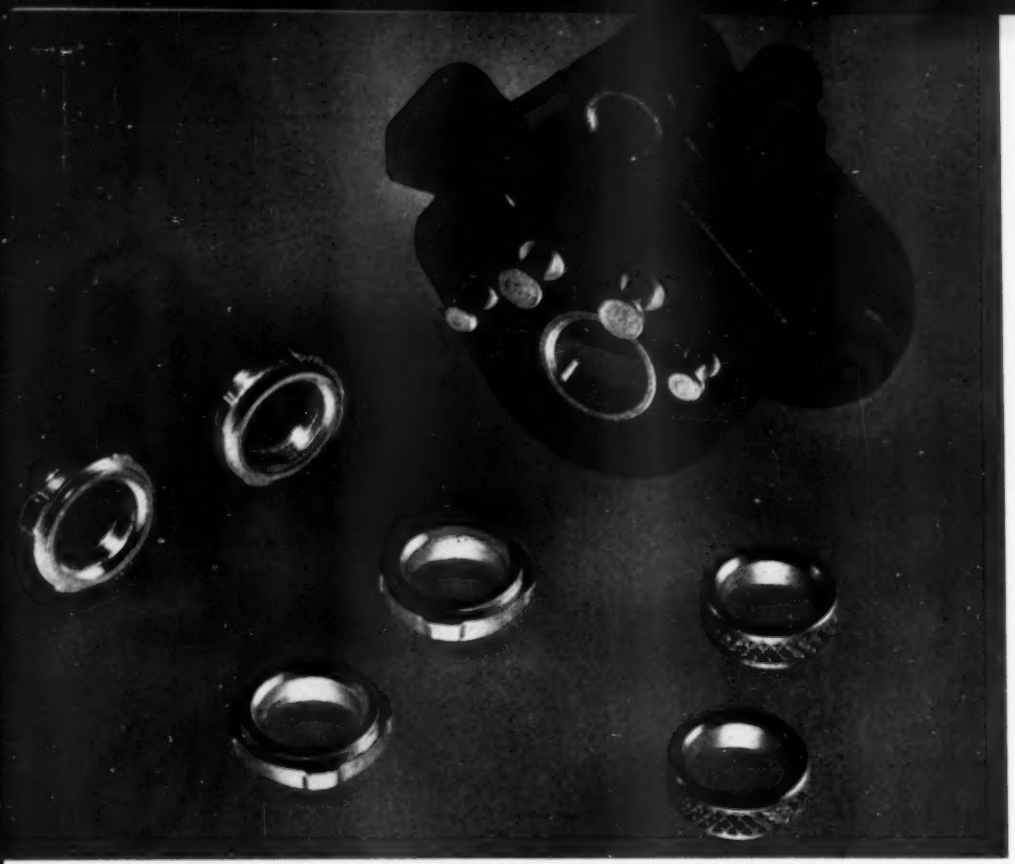
Relatively low cost

Because diamond abrasive wheel dressers are sold for the cost of the diamond only, the mounting must be inexpensive. This precludes the use of a special alloy made by ordinary melting and casting processes. Even if the initial development costs were not a factor, the production of relatively small melts of special alloy is an expensive proposition. For the most economical usage, such melts would probably have to be fabricated into wire, strip or shot at an additional cost.

The reasons detailed above all point to the the use of a mixture of metal powders and regular powder metallurgical techniques to prepare the required alloy and to mount the diamond in the holder. An alloy of the required properties has been developed by E. Karelsen, Inc., of New York. This alloy is a mixture of metal powders which, after sintering, has the desired properties.

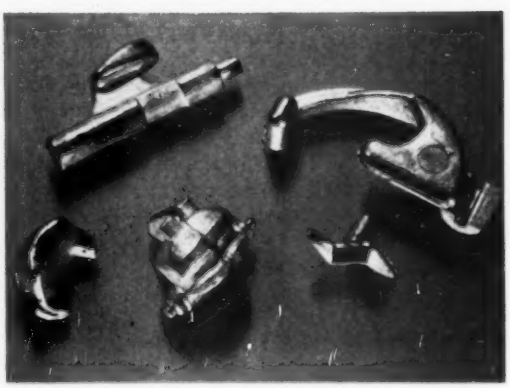
The method used in mounting the diamonds is of interest. The tool shank, held in a jig, is drilled to take both the diamond and a small amount of the alloy powder placed in the hole. The diamond is cemented into a small graphite holder and pressed into the recess on the holder. By the simultaneous application of pressure in the order of 200 psi and heat, about 1800F, the diamond is pressed into the alloy powder and the powder sintered. The operation forces the powder around the diamond so that mechanical bonding occurs and at the same time, there is an alloy bond formed between the cementing material and the metal holder.

After the sintering is completed and the tool cooled, the shank is chucked in a lathe and the excess metal of the holder removed so that the diamond is exposed.



GOOD BEARING PROPERTIES for light or intermittent duty are important design features of die cast zinc. Shown above are some small bushings die cast in zinc alloy and then used as inserts in the molded plastic frame for an electric shaver. The die cast bushings are presented at the left and the knurled, screw machine copper bushings that they have replaced are at the right. By casting four small ears around the circumference of the die casting, excellent anchorage in the plastic is obtained without the extra expense of a secondary knurling operation. All photos on these pages courtesy Dollin Corp.

Check through your inventory of small metal parts and you'll find some that involve too many operations or tolerance difficulties . . . These are "naturals" for the die casting process. This article tells why small die castings are frequently less costly than screw machine or stamped pieces.



YOU'D HAVE A HARD TIME reproducing any of these pieces from assembled stampings — they would be impossible by screw machine — but as small zinc die castings they are relatively simple and inexpensive. Two castings, lower left, are counterweights used in dolls' eyes; upper left is a spring actuated fastener. The S-shaped piece, lower right, gets a plated finish, and upper right is an example of a complex contour.

The EXTRA VALUES of Small Die Castings

By J. R. SCHUCHARDT*

SMALL die castings have certain special advantages in addition to those generally attributed to medium and large die castings. The great economy of the die casting process, in comparison with other fabricating methods, is most apparent in the production of small pieces.

In the first place, the development of special, high-speed, automatic or semi-automatic machines for producing small die castings has made possible ultra-high production rates, minimum use of skilled labor, and resultant low unit costs.

Second, the arithmetic of figuring costs on small parts is such that a single secondary operation on a screw machine part, or the assembling of two small stampings, may represent a major part of finished piece costs; on the other hand, such features as cross slots, through holes and complex shapes can usually be incorporated into a single die casting.

Screw machine is a low cost production method, but is very limited in the shapes that can be produced economically. Likewise, the shapes and amount of surface detail practical in a stamping are also restricted.

A simple checklist of small parts to determine whether they might economically be produced as zinc alloy die castings is submitted:

- Do they fall within the approximate size range of three to 1000 pieces per pound?
- Are they being made by some method that is not automatic?
- Do they require one or more secondary operation?
- Is a high scrap loss involved?
- Are they being made of two or more parts that require assembling?

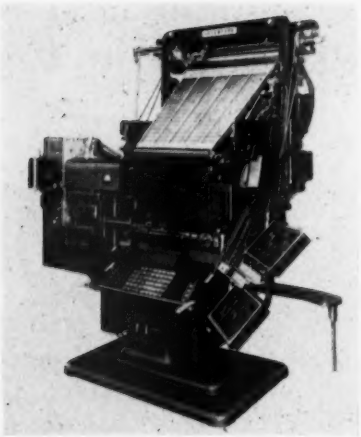
If the answer to any of the above questions is "Yes," then the possibility exists that the parts could be produced better

continued on page 85

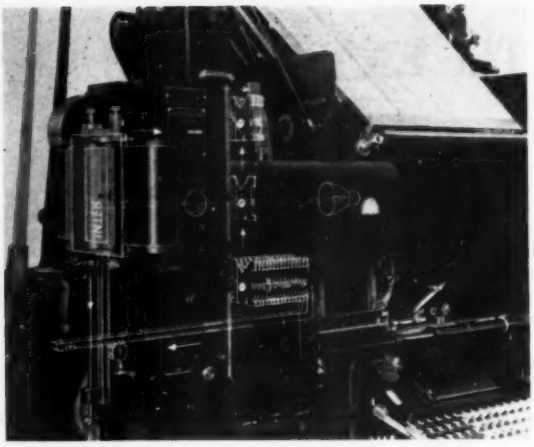
*Dollin Corporation.

TO PUNCH THIS PIECE from sheet stock would entail a staking or brazing operation to attach the two projecting lugs on the underside, it would involve considerable waste of metal from punched holes. It is the head plate for an electric shaver, and gains greatly in rigidity, detail and also, in lower cost, because it is die cast in zinc. Several tools would be needed to blank, form and pierce this piece by stamping.

DIE CASTING VS SCREW MACHINE: The two parts displayed here are good examples of the secondary operations that make screw machine pieces less economical than die castings. The cross slot on the ordnance plug, and the end hole in the square casting, are formed in the casting operation but require a separate setup on screw machine processing. These pieces are cast complete including the external thread.



1. NO POT OF TYPE METAL on this new Fotosetter . . . it composes lines of type using a camera and photographic film or paper.



2. INDIVIDUAL EXPOSURE of stationary characters and a circulating matrix system are features of the Intertype Fotosetter machine. Diagram illustrates movement of matrices in the photographing unit.

Investment castings in SPECIAL TYPESETTING save machine tool time

GRANDADDY of the die die casting process was a machine for casting whole lines of printers' type by injecting molten type metal against an assembled row of brass matrices engraved with various letters of the alphabet.

This contrivance of the typesetter's art presaged today's high production, precision metal forming process (by which molten metal is forced into a steel die and allowed to solidify).

However, a new method has been developed for setting printed matter without the use of an ounce of molten metal or a drop of ink. This newest invention in the field of mechanical typesetting replaces the pot of molten metal with a camera and roll of film or sensitized paper.

The machine is the Intertype Fotosetter* photographic line composing machine, Figure 1, which has recently been announced by Intertype Corporation aften ten years of development and four year trial operation in the U. S. Government Printing Office. More than 50 of the machines are now in daily operation in printing plants throughout the country.

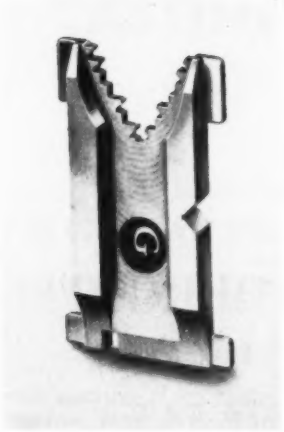
The Fotosetter is described by the manufacturer as "an automatic photographic line composing machine." It produces justified composition (having lines of equal length) in columnar form directly on film or photographic paper in one operation. This can be reproduced on offset-lithographic, gravure or letterpress plates by use of the standard plate-making methods.

A diagram of the ingenious photo-reproduction unit is presented in Figure 2, illustrating the manner in which the individual matrices containing letter negatives are brought together and then fed individually before the camera lens. Figure 3 shows one of the matrices with a transparent character inbedded in its side.

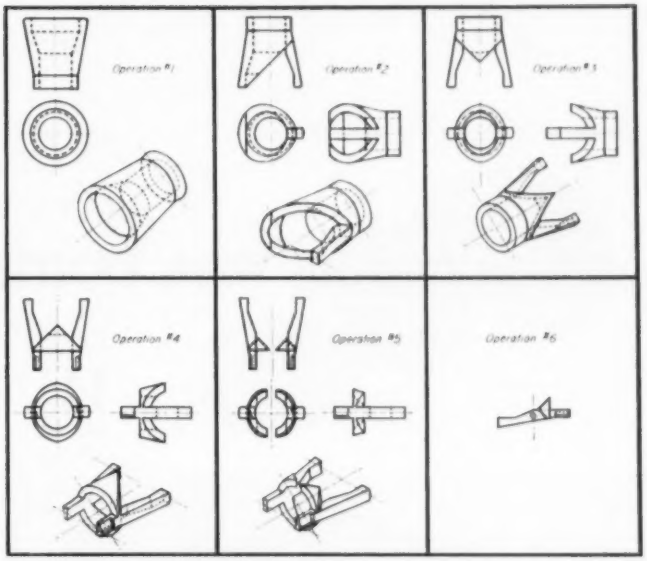
From pilot model to production model

The Intertype Fotosetter depends for successful operation upon multiple, closely syn-

*Registered trade mark.



3. FOTOMAT MATRIX has transparent character imbedded in its side. The older, line casting machine matrix has the character recessed in its edge.



4. SIX STAGES OF MACHINING a distributor box clutch pawl are depicted above. A pair of pawls are produced simultaneously by the series of machining operations which start with a hollow tubular shape having stepped inside diameters and tapered outside diameter.

MACHINE

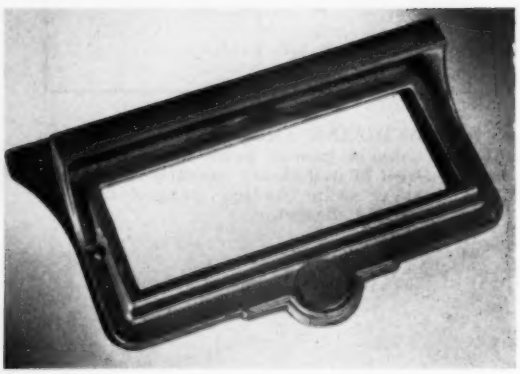
chronized secondary functions such as selecting and feeding the matrices by means of a keyboard, justifying (equalizing) the length of lines, positioning and photographing individual characters, sorting and returning matrices into their proper storage compartments, etc. To accomplish these functions rapidly and automatically, a complex mechanical system has been devised in which are included a large number of irregularly-shaped components.

During early stages of machine development and the production of pilot models, many of these pieces were laboriously machined from the solid, consuming hours of

continued on page 78

5. TYPICAL INVESTMENT CASTINGS that go into the Fotosetter machine are grouped below. The casting, top center, with extended wings and complex cam surfaces, is the investment casting which has replaced the machined piece shown in Figure 4. A beryllium copper brush holder with dovetail groove to hold a nylon brush is shown at left, and a complicated alternating wheel is at right.

One-Piece Casting With CORED UNDERCUT



SMOOTHER than a sand casting and with an undercut that couldn't be produced economically in a die casting, this frame is permanent mold cast in aluminum alloy.

DURABLE organic finish is no problem to apply to enhance appearance of this holder for illuminated house numbers.

WHEN is permanent mold casting economical? From time to time, numerous rules of thumb have been advanced, but always with the admonition that there are numerous exceptions.

The permanent mold cast frame for the illuminated number shown at left is one of the exceptions.

Sand casting is economically impossible since the amount of finishing that would be required on such a casting would increase the manufacturing cost to such an extent that the finished number illuminator could not be sold. As a permanent mold casting, however, the as-cast surface is completely adequate so that after the gate is removed, the casting can be painted.

As a die casting, the surface would be much smoother than is actually necessary. The piece cost would probably be somewhat lower, but the most desirable shape includes a hood to protect the lights used for illumination and to house a reflector. This shape is such that the part cannot be die cast as a single piece because there would be an undercut.

As an assembly of two die castings, a gasket would be required in addition to fastening devices of some sort; section thickness of the hood casting would probably have to be increased to accommodate fasteners and a considerable amount of drilling, tapping and possibly surface sanding would be required.

Such an assembly, in addition to being more costly when finished, would lack the rigidity of a single casting and would be somewhat heavier.

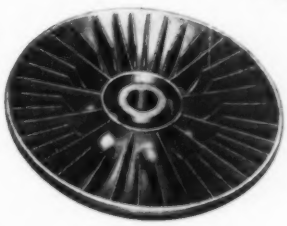
As can be seen in the illustration, the centers for the mounting holes are spotted in the casting operation. As a die casting, these holes would be cored, but the saving resulting from this would not compensate for the added cost of assembling the two pieces.

The reasons cited above indicate why, even though the number of pieces per year is considerable, permanent mold casting is the most economical method of production.

CASTINGS BY Thompson

ARE ENGINEERED TO WITHSTAND GREATER HEAT
•
THEY'RE LIGHTER IN WEIGHT
•
SAVE ON FINISHING
•
ARE STRONGER

Outboard Propeller



Gyrol Fluid Coupling

Garbage Disposer Housing

Motor End Frames

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Here are two ways a manufacturer of dial telephones meets CUMULATIVE TOLERANCES

DIE CAST ZINC VS DRAWN BRASS . . .

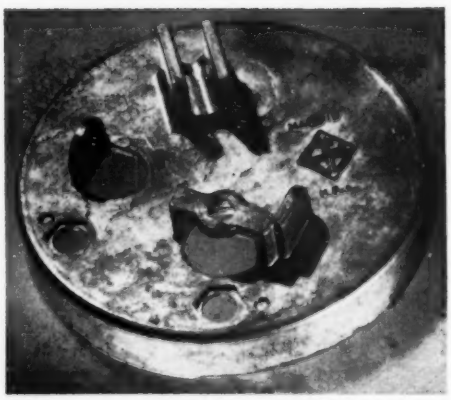
At the time the dial base was redesigned — about 10 years ago — there was relatively little difference in cost between the drawn brass unit and the finished zinc die casting.

The base was drawn from 14 gauge brass sheet, holes were perforated and three additional stampings were assembled to it. The bearing support bridge was staked in position and a two-piece steel bracket to support a spring was welded.

With a die casting, all three of these attached pieces are eliminated, although the base still requires the punching and drilling of holes and the performance of other secondary operations. As a matter of fact, the same perforating tools that were used on the drawn base were continued in usage on the die castings.

Ejectors are located around the rim of the casting to help maintain flatness. The ejector pads therefore have made it necessary to turn the inner rim to form a rabbet. The perpendicular lug must be squared up, as it was on the stamping.

The castings are produced in a single cavity die because of the closeness of tolerance that must be held. Drawings call for ± .002 which is considerably closer than normal commercial die casting tolerances. Even so, some holes that need closer location are drilled. Some of these are held to ± .001 or closer on centers.



On through holes, a thin section is purposely left in the castings to be punched out because this can be maintained with greater uniformity than would be possible if normal flash were allowed to form. With a uniform web, more uniform punch action can be achieved.

Flatness is critical, with inside surfaces held at ± .006 over a diameter of 3 inches. Distortion would throw gearing out of alignment and interfere with smooth, quiet operation that is essential in dial equipment.

Two commercial die casters are producing these critical dial bases: The Electric Auto-Lite Company and Doehler-Jarvis Div. of National Lead Co.

WHEN one stamping is mounted onto another, the problem of holding cumulative tolerances is multiplied. This is likewise true when several setups are needed to machine a piece of bar stock.

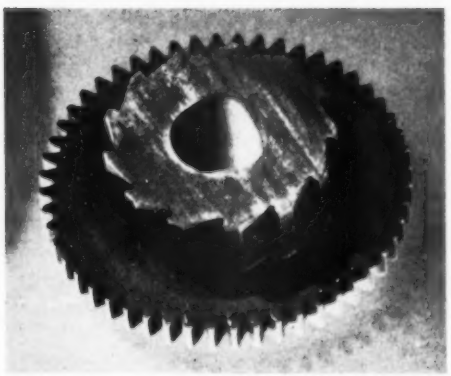
This consideration more than any other has influenced Automatic Electric Company of Chicago to introduce die castings and sinterings into the automatic dial telephones which they manufacture.

Two typical examples from current production are illustrated here, one a die cast zinc dial base and the other a combination gear and ratchet produced from powdered bronze.

The one-pece die cast dial base replaced an assembly of stampings mounted onto a drawn brass shell; the sintered bronze gear-and-ratchet was previously cut from Naval brass in seven operations.

Many thousand pieces are used per week. It can, therefore, be appreciated that handling, inspection and inventory are of greater significance than initial tooling costs.

SINTERED GEAR VS MACHINED ROD . . .



A determining factor in converting from machined brass to sintered bronze for the gear-and-ratchet is the need for high tooth strength. During dialing, the teeth of the ratchet are subjected to repeated impact, necessitating sufficient strength to resist breakage.

The life of gears produced by powder metallurgy has proved satisfactory. Careful attention to pressing and sintering on the part of the supplier, Powdered Metal Products Corp. of America, has given the uniform density and strength needed by the teeth.

By switching to powdered metal, a saving in piece cost has been accomplished while, at the same time, guaranteeing uniformity and eliminating multiple machining operations. Sintered pieces cost about 75 percent as much as machined pieces.

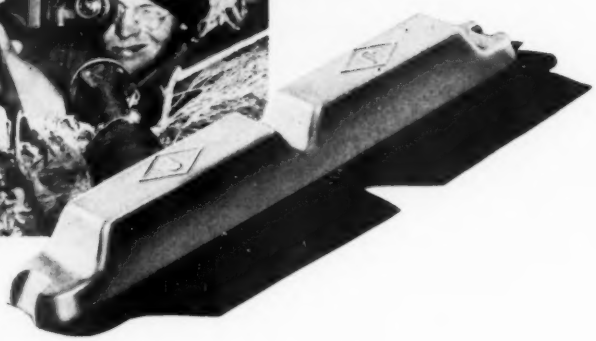
The cycle of operations previously required included:

1. Cut blank on screw machine;
2. Drill locating hole;
3. Rough broach the ratchet;
4. Finish broach the ratchet;
5. Turn a relief beneath ratchet on screw machine;
6. Hob gear teeth;
7. Wire brush burrs.

One of the most bothersome of operations was the final one, removing burrs with wire brush. Such burrs are slow and difficult to clean off, and yet this is necessary for proper operation. There is no burr removal problem with sintered gears.

One other consideration is worth noting. At a time of copper allocations and shortages, Automatic Electric sought every means of conserving this metal. Due to the fact that there is no scrap loss on sintered gears, and the density is lower than that of wrought stock, only about 66 percent as much material is needed. Projecting this saving over production run of several thousand pieces per week results in a very worthwhile saving.

U. S. Army Photograph



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MECHANIZED SHELL MOLD CASTING

RAPID development of the shell molding process has brought with it a number of machines and materials for mechanizing and improving the production of castings. Time consumption has been one of the early drawbacks of the process, but this is gradually being overcome as these new developments are introduced.

A new shell mold machine recently introduced is presented here together with the manufacturer's claims for it.

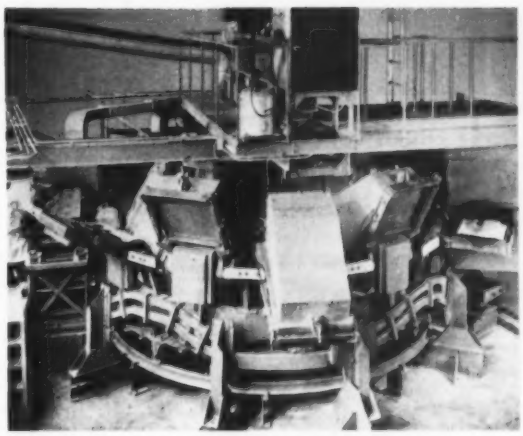
A 12-station unit, designed and built by Mechanical Handling Systems, Inc., Detroit, will make approximately 500 shell molds per hour. The machine is automatic, requiring only one man for operation. Pattern size on the standard machine is 28" x 22".

Operation of the unit is smooth, continuous and mechanically simple. Beginning at left in Figure 1 and traveling counterclockwise, a finished shell mold is removed from the pattern. Next, the pattern carriage moves up and engages the sand-resin hopper. Pattern and hopper, clamped tightly together, swing forward to below the horizontal, the material falls on the pattern forming the shell mold.

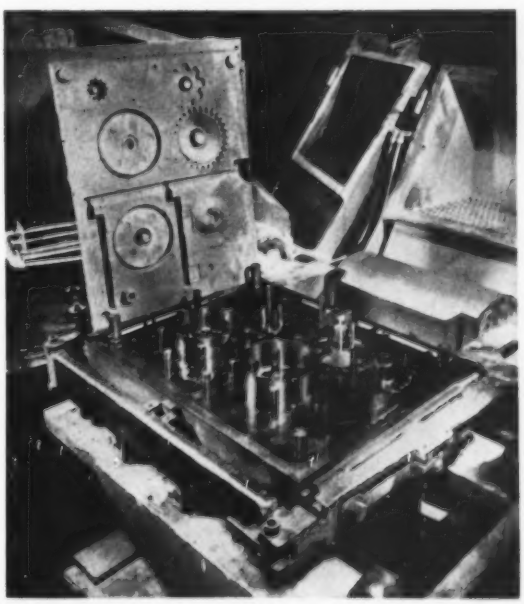
Pattern and hopper now rise, the hopper is disengaged, and the pattern carriage, with its soft shell mold, returns to the horizontal and enters the oven. The mold travels through the oven which is heated with gas-fired radiant burners, and is fully cured when it emerges at station at the far left of the photograph. Here the mold release pins lift automatically, the mold is removed and the cycle starts again.

At the top of the machine is located the automatic proportioning system for sand, resin, and wetting agent. These materials are thoroughly mixed and are deposited in controlled quantity in the hoppers at each revolution of the machine.

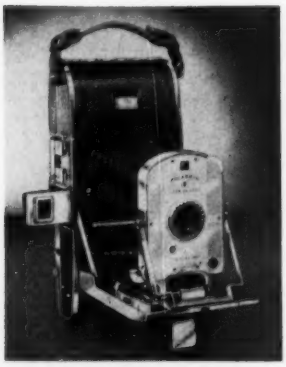
Pattern plates may be changed quickly, without stopping the machine, which provides for extreme flexibility of production. The machine may be operated with all patterns producing the same molds, or with 12 different patterns.



1. THIS 12-STATION MACHINE can produce 500 shell molds per hour. It is automatic, from sand and resin blending to the finished mold. A single workman attends the machine, which rotates counterclockwise through mold forming, curing and to finished mold delivery at the left.



2. CLOSE-UP of a pattern at the mold delivery position of the 12-station shell molding machine.



1. ALIGNMENT is more critical in this Polaroid camera than in more conventional models.

RIGID STRUCTURE: Basic design factor in camera construction

2. MOUNTING for the film holders, focal plane, film guides and hinged bridge is provided by this body casting.

3. LIGHT-TIGHT closure is required between this rear cover and the body casting.

THE Polaroid Camera, Figure 1 is different from most cameras because it produces a finished picture. In order to carry out the delicately controlled chemical process that produces a finished print within a minute, the camera must do its part with unfailing accuracy.

The camera must contain not only the usual roll of negative film but also a roll of positive material on which the final picture is produced. It must bring the two films together in accurate alignment and spread a precisely controlled layer of fluid between them. The exposed area of negative film must be registered with a corresponding area of positive film. The camera must know when this has been done and stop the operator from pulling the film further.

Each load of film has material for eight pictures, or roughly five feet of film in each strip. As the two films are brought together and a fluid layer spread between them, they stick to each other and cannot be skidded to correct mis-alignment. This places a new and unusually stringent requirement on the camera mechanism. All parts of the film guiding structure must be both rigid and perfectly aligned if the films are to be fed together exactly parallel and mistracking or jamming are to be avoided.

In addition to these rather unusual demands upon the camera structure and film handling mechanism, one-minute photography demands more accurate control of the original exposure than does conventional photography. This means the shutter must be calibrated to much closer timing tolerances than is usual in the industry.

In conventional photography errors in exposure are compensated for in subsequent processing in the dark room, but here exposure is the operator's fundamental control of his picture. The shutter must do what its setting promises, and if it does not, its failure is apparent as soon as the finished picture is seen. To produce this kind of ac-

continued on page 50

KUX

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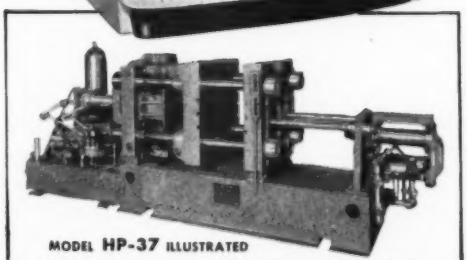

MODEL **HP-37** ILLUSTRATED
Hydraulically operated die casting machine for production of aluminum castings.

Battery of KUX Die Casting Machines in operation in the ultra-modern Maytag factory at Newton, Iowa

—helps make

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first name in washers

Since 1907, over 6 million Maytag Washers have been sold—far more than any other. The reason's clear; Maytag makes a wonderful washing machine . . . plus a full line of other home laundry equipment and famous Dutch Oven Ranges. It's logical that KUX, first name in die casting machines, should be used in the quality production of these superior products.

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BETTER METHODS
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BETTER DIE CASTINGS
SINCE 1919

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Sound engineering, metallurgical knowledge and skilled techniques have achieved and maintained a standard of superior quality.

SUPER CAST has kept faith, always deserving the mark it bears. SUPER CAST means die castings for those who want the best.

A sound, time-tested institution and a sound time-tested product have won confidence and widespread endorsement.

DEPENDABLE
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DIE CASTINGS
BETTER DIE CASTINGS
SINCE 1919

THE SUPERIOR DIE CASTING COMPANY
1001 London Road CLEVELAND 10, OHIO

For additional information Circle No. 47 on the Reader Service Card

continued from page 48

curacy a new type of shutter was invented.

All of the requirements of this new kind of camera pointed to rigidity and accuracy as being fundamental. In addition, it had to be as light as possible and attractive in styling and appearance. Aluminum die castings were chosen early in the design stage as offering the best possibilities for a rigid structure that could be manufactured in large quantities and held within the small tolerances necessary.

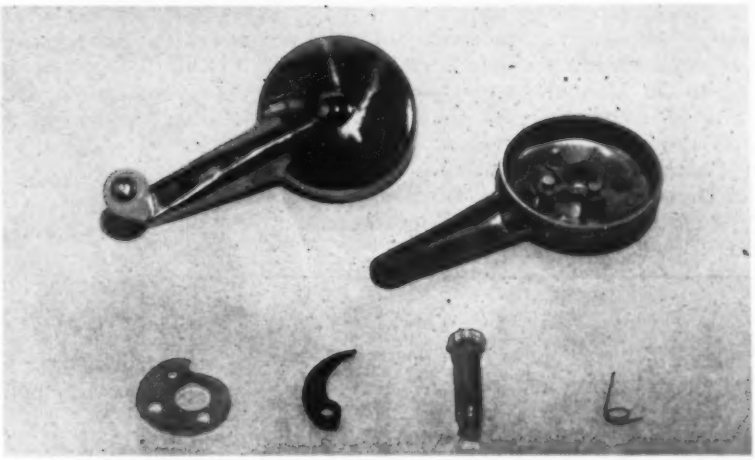
The largest die casting used is the camera body, Figure 2, which serves as the foundation for mounting the film holders, the focal plane, film guides, inner hinged bridge with its processing roll, and the hinged front and back covers. Stiffness, freedom from warping and reproducible accuracy are prime requirements for this part.

Hinged to the open back of the body casting is the rear cover, Figure 3, which not only completes the camera body to make a light-tight closure, but also carries a processing roll which must mate precisely with the one carried by the inner bridge.

Rigidity was a particularly difficult problem with this part since much of it is cut away to provide an opening through which the finished picture is removed from the back of the camera. The opening is closed with a fabricated hinged and light-tight door which can add little strength to the cover as a whole.

The shutter housing is a pair of die castings, Figure 4, so arranged that all the mechanism is carried by the front casting. Many of the bosses, spring mounts and mechanism seats are cast in place inside the housing. This considerably reduces the number of assembled parts and at the same

continued on page 85



COMBINING MANY PARTS into a one-piece die cast construction saves money and time in manufacturing this handle for a can opener.

ASSEMBLY CAN BE SIMPLIFIED
by die cast mounting and fastening elements

TODAY, the competition to build a better mouse trap may not be as keen as formerly, but building a better can opener is big business. Not only must the device remove the top from a "tin can", but it must do it easily, quickly and neatly. There can be no rough edges left and the top, after being cut out, may not fall into the peaches. In addition to all this, the can opener must present a pleasing appearance, be easily cleaned and harmonize with any and all kitchen interiors. Finally, the cost must be low enough so that no sales resistance due to retail selling price will arise.

The new models manufactured by the Swing-A-Way Corp. of St. Louis, Mo., fulfills all of the requirements. In order to make the opener as nearly automatic as possible, the designers provided a cam and hook assembly which, when the handle is turned backwards (that is counter clockwise) would open the cutting blade to allow insertion and removal of the can. This assembly had to be contained within a circular section of the handle to keep the overall size of the assembled unit as small as possible.

Two obvious methods of manufacture of the handle presented themselves. Either an assembly of pressed sheet metal parts or a casting. Preliminary engineering estimates showed that the use of assembled stampings would run manufacturing costs to an excessively high figure. Die casting was, therefore, selected as the most economical method of fabrication.

Two views of a handle are shown above together with the various parts of the hook and cam which go to make the opening device.

Features of the die cast handle which make it the most economical from a manufacturing standpoint are:

- Unitary, one-piece construction.
- Mounting bosses and rivets integral part of the aluminum die casting.
- Adequate anchorage of main steel pin secured by knurling pin and pressing it into a cored hole in the casting.
- Hole for knob pin cored in casting.
- Part ready for surface finishing and assembly as received from vendor.

The casting, as made by the Republic Die Casting Co. has a hardware finish so that only a minimum amount of preliminary surface finishing is required. The use of multiple cavity die, in this case four cavities, further reduces manufacturing costs.

FOUNDRYMEN ADVISED HOW TO SELECT SAND FOR SHELL MOLD CASTING

A cheap sand is not always an inexpensive shell molding sand, according to Dr. Manuel F. Drumm of Springfield, Mass., research group leader in Monsanto Chemical Company's Plastics Division.

Addressing the 57th annual meeting of the American Foundrymen's Society in Chicago recently, Drumm admitted that cost and availability are important factors in selecting a sand for shell molding. He pointed out, however, that there are other less obvious considerations which can be equally important. Among them he listed particle distribution, grain shape and condition of the sand surface.

Drumm warned that the use of cheap sand often makes necessary the use of extra large amounts of resin to produce suitable shells. Since the resin content of each shell is more costly than its sand content, use of cheap sand in the long run may mean more costly shell production.

Drumm also emphasized the importance of choosing the proper resin for each job. He told how his company has developed a variety of resin formulations to produce efficient resin-sand mixes.

Studies are now underway, Drumm said, to find new ways of cutting down on the amount of resin necessary to produce satisfactory shells. He said that in the future more efficient utilization of resin may be achieved by one or more of the following methods:

1. Thermal coating of sand with thermosetting binders.
2. Use of alcoholic solutions of conventional binders.
3. Use of liquid phenolic resins for sand coatings.

Drumm outlined several test procedures his company recommends for evaluating resin-sand mixes. Of these, he described the flexural and tensile tests as most useful.

Once the strength properties of a mix are verified by these two tests, Drumm suggested additional testing for shell thickness, peeling, hot rigidity and packing on vertical surfaces, If the mix successfully weathers these tests, Drumm said that production on a limited scale may proceed with reasonable confidence.

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British ordnance company finds A WAY TO SAVE LABOR AND SPACE

IN England during the past several years, increasing attention has been given to the possibilities for saving production costs by use of investment castings.

According to a report published by British Information Services, Birmingham Small Arms Company has devoted more than six years of research on the use of investment casting of steel components for ordnance components.

Comparing plant requirements of investment casting with those needed to produce comparable parts by machining, BSA has come up with some interesting figures. Calculations based on a production run of machine gun magazine platforms selected as a typical range of components, showed:

- Machining methods required a labor force of 68 and a floor space of 10,000 square feet.
- Investment cast components called for a labor force of 44 and 7,000 square feet of floor space.

A group of typical BSA components being produced by investment casting is presented in the photograph above.

Important savings that have been noted by the Birmingham company include reduction in metal loss in turnings and scrap, and elimination of a great deal of setup time.

Sprues, gates and any rejected castings can be returned to the melting pot and reused so that scrap loss is negligible. This contrasts with machining practice in which a high percentage of the wrought material is machined away into turnings which cannot be reclaimed except as scrap metal.

Likewise, when normal machining methods are used, a change in components would require complete reorganizing and sometimes re-equipping the production line. On the other hand, a change in investment castings requires only change in pattern-making dies. The investment casting plant can produce one shape as readily as another with the same basic equipment.

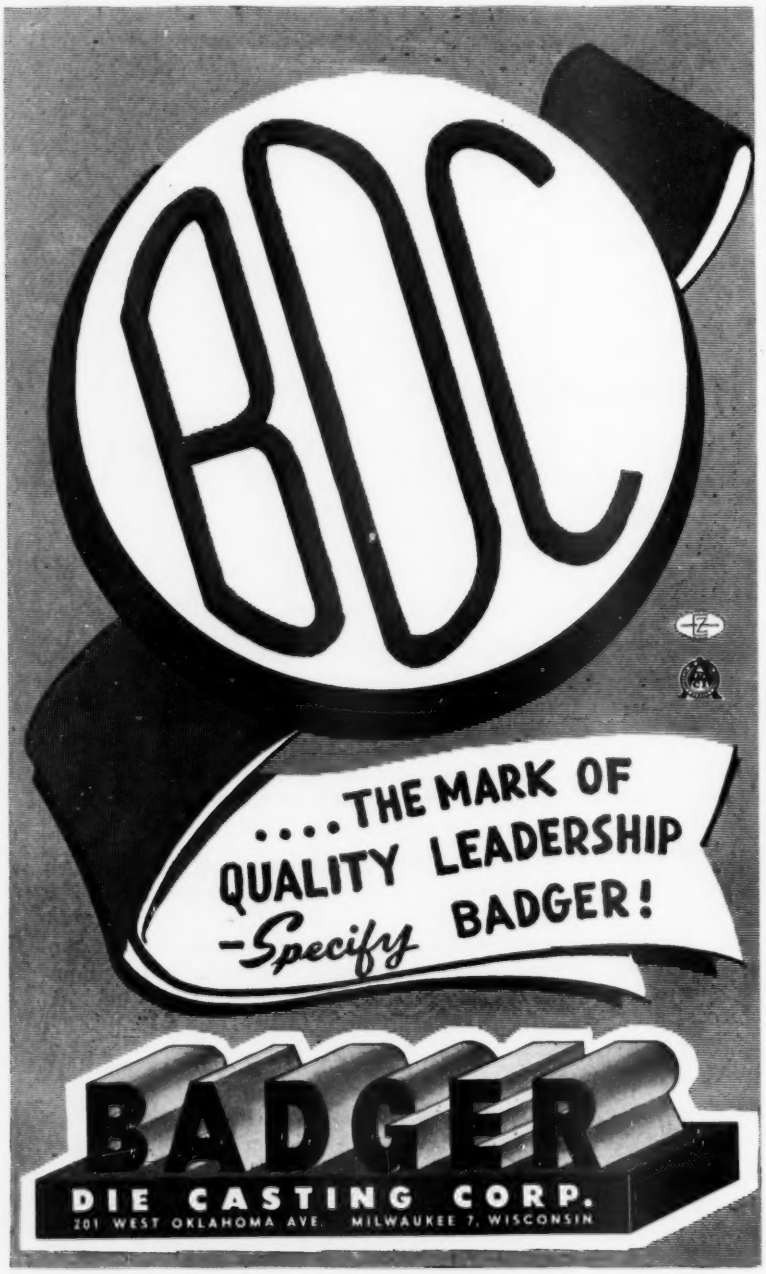
INVESTMENT CASTING INSTITUTE IS FORMED; MEET TO ELECT OFFICERS

Having voted last month to form the Investment Casting Institute, an organization of commercial investment casting firms, the members of the new organization are scheduled to meet for the first time as a formal body June 12, at the Williams Club, 24 East 39th St., New York.

Formation of the Institute was voted by a major group of investment casters and representatives of affiliated industries on May 8 in the third of a series of exploratory meetings held by the group since the first of the year. This is the culmination of moves initiated in January when the first industry-wide meeting was held in Cleveland under the auspices of Precision Metal Molding magazine.

The 31 companies who were represented at the May meeting voted overwhelmingly to form the Institute and, at the same time, adopted a basic constitution setting forth conditions of membership, objectives, financial structure, and other pertinent factors. Officers and board of directors will be elected in June.

Some of the initial goals that the newly formed Institute has set are standardization of nomenclature, standardization of as cast properties insofar as possible, creation of a publicity and new bureau, and the gathering of statistics



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OPERATION ALLOY

The function and importance of the aluminum smelting industry were demonstrated to the man in the street recently by a two-week display in a downtown Cleveland window. Apex Smelting Company, now celebrating its 30th anniversary, used photographs, art work and actual representative scrap piles and examples of finished aluminum ingot and castings, in the display called "Operation Alloy." The exhibit in three windows of a prominent Cleveland bank, was staged by Apex' Cleveland plant with the backing of the company's home office and plants in Chicago, and Los Angeles.

INDUSTRY NEWS

GEORGE SALL METALS OPENS NEW METAL PLANT

On its 8-acre property at 2300 East Butler St. in Philadelphia, The George Sall Metals Co., Inc. has opened a new, completely modern plant for producing non-ferrous ingot from scrap materials. The new plant, opened on May 27, consists of a 73,000 sq. ft. building of brick and steel. The plant is divided into separate operating sections for brass, lead, zinc and aluminum smelting operations.

One of the features of the plant is its laboratory which includes spectrograph, colorimeter, metallograph, densitometer, micrograph, grain measuring microscope and tensile testing equipment.

R. F. WAINDLE ELECTED PRESIDENT OF ASTE

Roger F. Waindle, vice president of Cannon-Muskegon Corp., was elected president of the 25,000-member American Society of Tool Engineers which held its 21st annual meeting in Detroit recently. He succeeds L. B. Bellamy of Detroit.

R. F. Waindle

More than 1,500 production experts from United States and Canada who attended the three-day sessions, heard 22 technical papers which featured the automation of industrial methods and machines.

Most frequently heard comment during the meetings was the repeated emphasis on the need for more engineers to serve all phases of industrial production from research to production.

Need for engineers was first voiced during the two-day leadership conference which

continued next page

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preceded the national meeting. Kenneth Meade, General Motors Education Relations Section Head, told the 105-chapter chairmen assembled for the conference that the United States was 95,000 short of having enough engineers.

CASTING COMPANY PUTS ON ART SHOW IN NEW BUILDING

A manufacturer of aluminum and magnesium permanent mold castings offered an outstanding exhibition of contemporary art recently in week-long dedication of his new office building, and attracted 5,000 visitors.

The building, to be shared by Meta-Mold Aluminum Company and Meta-Mold Magnesium Company in Cedarburg, Wisc., has a large permanent collection of works of art, as well as the works loaned for the opening exhibition. In the company's foyer is a large mobile, 18 feet in diameter and five feet high by the distinguished artist, Alexander Calder, commissioned by Otto L. Spaeth of New York, chairman of the board of each firm. Pete Watry of Cedarburg is president and general manager.

The two companies are not affiliated, but have the same management and share the same tool room facilities. They have been producing permanent mold castings in the light metals for many years.

GEORGE H. BINNS JOINS ATLANTIC CASTING

Atlantic Casting & Engineering Corp., 810 Bloomfield Ave., Clifton, N. J., has announced that George H. Binns has joined their organization as engineer, after having completed a second tour of duty with the U. S. Navy.

A chemical engineering graduate of Lehigh University, with two years additional study at M. I. T., he was associated with Goslin-Birmingham, in Birmingham, Ala., and was instrumental in design and supervision of installations, as well as sales.

G. H. Binns

Mr. Binns will be available as service engineer and salesman for Atlantic Casting customers in the New York metropolitan area and northern New Jersey.

During his recent tour of Navy duty, Mr. Binns served in Guam and Okinawa as administration officer and later as communications officer.

ACCURATE Magnesium Die Castings . . . a new note in WURLITZER ORGAN quality

Large two piece magnesium die cast reed holder produced for the Wurlitzer Co.

The change from a heavier metal casting to ACCURATE magnesium die castings reduced weight and production costs for the Wurlitzer Co. Priced competitively with heavier metal castings, these matched magnesium die castings were lighter to handle, machine, and assemble . . . are shock-resistant . . . non-rusting and dimensionally stable. ACCURATE die casting engineers would welcome the opportunity to work with you in adapting magnesium die casting to your product. Write today for recommendations and cost estimates.

Here are a few additional advantages combined in each ACCURATE Magnesium Die Casting:

- Light Weight
- High Strength
- Low Cost
- Fine Surfaces
- Close Tolerance
- Uniformity
- Laboratory Controlled Quality

Major Producer of Aluminum, Zinc and Magnesium Die Castings

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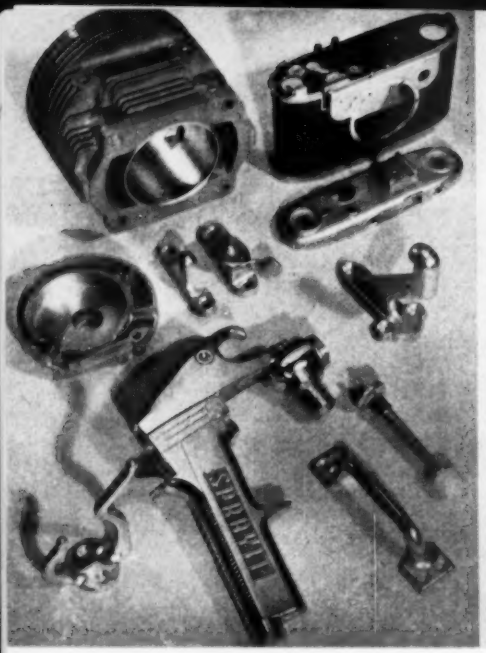
Finishing Section

SURFACE FINISHING

Most precision metal molded parts receive some type of surface finish such as plating, organic coating, anodic coating, or chemical coating. This section includes information on the methods, processes and equipment used in these surface treatments.

A Section Devoted to Specialized Finishing of

Die Castings • Investment Castings • Powder Metal Parts
Permanent Mold Castings • Plaster Mold Castings



APPLICATIONS OF PLATING on aluminum die castings include: hard chrome plate on cylinder bore and pump housing; satin chrome on camera case; bright chrome on spray gun body; and brass on various hardware items.

APPLICATIONS OF ANODIZING on aluminum die castings include the Alumilite finishes shown at right: black on aircraft instrument and gun parts; red on fishing rod handle and spectacle frames.

FINISHING SYSTEMS FOR ALUMINUM DIE CASTINGS

By R. V. VANDEN BERG*

What finishes are practical on aluminum alloy die castings?

- **Polishing and Buffing**
  The smooth surface of aluminum die castings require less work to develop a mirror-like finish.
- **Barrel Finishing**
  Bulk finishing in rotating barrels is one of the most important ways to finish aluminum die castings.
- **Chemical Treatments**
  A variety of chemical treatments are available to protect the surface or to provide a bond for paint.
- **Electroplating**
  Aluminum die castings can be plated if proper attention is given to the surface prior to plating.
- **Anodic Coatings**
  Oxide coatings applied electrolytically are resistant to corrosion and abrasion.
- **Organic Coatings**
  Excellent adhesion and wide range of colors and textures are suitable for aluminum die castings.

THE commercial applications of aluminum alloy die castings are numerous. Their light weight, low cost and dimensional stability are characteristics that make them a reliable commercial product. For many applications, the "as cast" surface is satisfactory; however, for certain applications, it is necessary to apply some type of surface finish for additional protection or to obtain some decorative effect.

Aluminum alloy die castings respond to a wide variety of finishing treatments. Among the more important are burnishing, buffing, painting, lacquering, enamelling, electroplating, anodizing, etching and chemical treatments of the surface conversion type.

Polishing and buffing

Aluminum alloy die castings have a smooth surface, a characteristic of this type of product. This is advantageous, because less polishing is required to produce a smooth mirror-like finish for certain applications. Polishing or "oiling" is required, however, to remove projections caused by "gating", ejection pins or parting lines. As in the case of die castings made from other metals, this polishing should be kept to a minimum so that excessive amounts of surface metal are not removed.

In general, die castings have a dense smooth outer surface but may have some sub-surface porosity. Excessive grinding of the surface may cause areas of this porosity to be exposed. Polishing to remove surface irregularity is carried out using rag, felt, canvas or leather wheels faced with 60 to 220 mesh emery and operated at peripheral speeds of approximately 6000 fpm.

Methods based upon the so-called "backstand principle" are also employed and have certain advantages provided proper contact wheels are used with sufficient lubricant of the correct type. Lubrication during polishing is extremely important, as it prevents loading of the abrasive surface which causes overheating of the metal and objectionable "tearing" of the surface.

For many applications, particularly designs with surface having complicated contours, the various grades of "satin finishing" or "deburring" compounds commercially available are excellent for removing mild surface irregularities. Smooth surfaces with maximum luster are obtained by buffing with stitched muslin followed by coloring with loose unstitched muslin after polishing operation. Tripoli compounds are generally used for buffing, whereas rouge or silica compounds are the most suitable for the coloring operation. Peripheral speeds of 7000 - 8000 fpm are recommended for best results.

Satin finishes are attractive and desirable for many applications. These finishes are applied using one of the many proprietary "satin finishing" compounds previously mentioned or rotating wire wheels operated at 600 to 1000 peripheral fpm.

Stainless steel wire wheels are preferred; however, if steel, brass, or nickel silver wire wheels are used, a short dip in concentrated for 1-1 nitric acid solution is recommended after brushing to remove embedded metal particles which might cause undesirable corrosion or staining of the surface.

Barrel finishing

One of the most important types of mechanical finishes applied to aluminum alloy die castings is based upon barrel burnishing methods. This simple procedure is low in cost and can be used to smooth and brighten the surface. Variations in technique will remove parting lines, gate marks and other irregularities.

Barrel burnishing is generally carried out in wood or rubber lined barrels operated at 8 to 40 rpm. The time required for burnishing varies from 20 to 60 minutes depending upon the size and shape of the article and the type of finish desired. If removal of surface metal is required, the castings are mixed with granite chips or one of the appropriate products which are commercially available.

If the surface is to be given a luster, only steel balls, diagonals, stars and other shapes appropriate for the particular article are mixed with the castings. A mixture of water and a burnishing compound, which is a neutral soap, is used to lubricate the articles while the barrel is in motion.

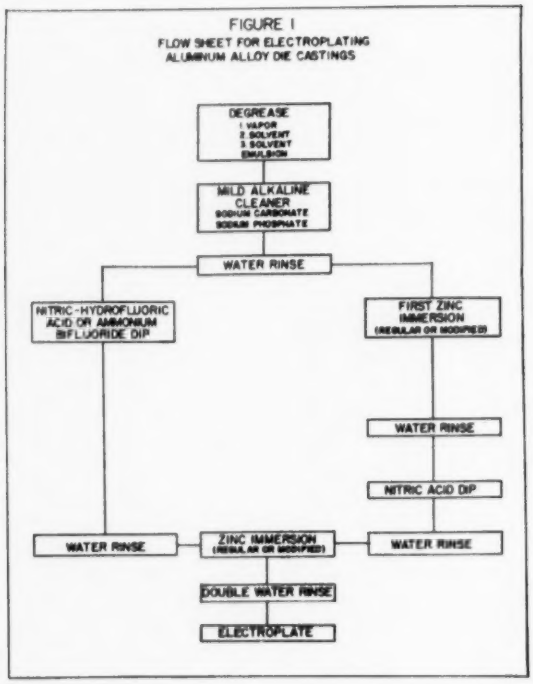
An important consideration in barrel burnishing is the soap used in the mixture. Care should be exercised so that strong alkaline soaps are not used, as the action of such soap on aluminum produces chemical attack resulting in the evolution of hydrogen. Accumulations of this gas under pres-

continued next page

THE AUTHOR: Russell V. Vanden Berg has been head of the Finishes Section, Process Development Laboratories of Aluminum Company of America since 1946. He is a graduate of University of Michigan with a B.S. degree in metallurgical engineering. Among outstanding work Mr. Vanden Berg has contributed to the progress of the aluminum industry in the development of high temperature fabrication techniques for magnesium alloys and for 75S.

Many types of finish can be used:

FIGURE 1
FLOW SHEET FOR ELECTROPLATING ALUMINUM ALLOY DIE CASTINGS



sure in the barrel can cause accidents when the barrel covers are removed to eject the load.

In general, the aluminum alloy die castings are allowed to mix freely with the abrasive chips or steel burnishing shapes. The ratio of castings to the burnishing chips or shapes is generally 1:2.

If the castings are large or fragile, they are securely fastened to fixtures routed in the barrel and the burnishing mixture is slushed against the castings by the rotation of the barrel.

Many specialized applications require that the castings be given some type of etch prior to barrel burnishing. This etching procedure in combination with certain techniques will produce surfaces that actually appear to be buffed.

For the brightest surface, it is recommended that the steel shapes used for burnishing be free from rust and aluminum accumulations. These shapes should be washed in caustic soda solution periodically to remove the surface accumulation. This low cost method is ideally suited for mass production and will produce a finish in itself appropriate for the application or it may serve as a preliminary surface treatment for some other type of finishing.

Chemical treatments

The simplest chemical treatments are the various etches used to remove surface metal and give a uniform appearance. In general, alkaline solutions based upon caustic soda are used commercially. Because of the high silicon content of most aluminum alloy die castings, smudge develops during etching in alkaline solutions. This smudge must be removed in an acid solution containing fluorides either as hydrofluoric acid or some fluoride salt.

Present experience indicates that aluminum alloy die castings do not respond satisfactorily to the Alcoa R5 Bright Dip. Chemical treatments to prepare the surface for applications of paints, lacquers or enamels are used extensively for commercial production.

Many of the so-called "conversion treatments" also form coatings on the surface which have substantial resistance to corrosion. Among the treatments in use commercially are

Zinc immersion solutions and mechanism

TABLE 1

Standard Zinc Immersion Solutions	
Caustic Soda (Commercial 76%)	70 oz./gal.
Zinc Oxide	13 oz./gal.
Temperature — 70-80°F.	
Modified Zinc Immersion Solution	
Caustic Soda (Commercial 76%)	70 oz./gal.
Zinc Oxide	13 oz./gal.
Ferric Chloride Crystals	0.13 oz./gal.
Rochelle Salts	1.3 oz./gal.
Temperature — 70-80°F.	

$Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O$

$3Na_2ZnO_2 + 2Al \rightarrow 3Zn + 2NaAlO_2 + 4NaOH$

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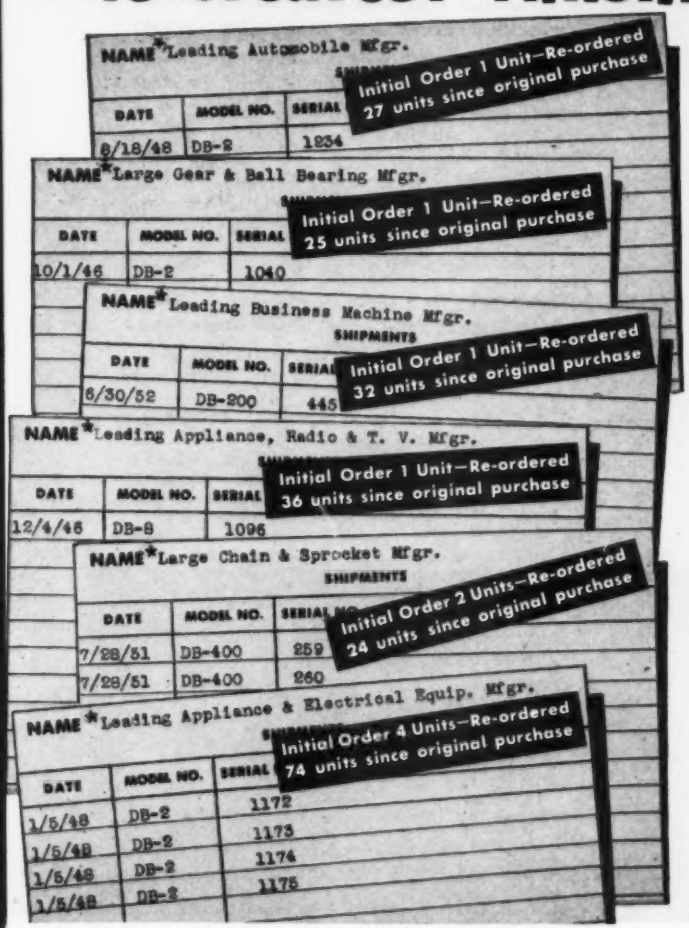
NAME* Leading Automobile Mfr.
DATE | MODEL NO. | SERIAL
8/18/48 | DB-2 | 1234
Initial Order 1 Unit—Re-ordered
27 units since original purchase
NAME* Large Gear & Ball Bearing Mfr.
DATE | MODEL NO. | SERIAL
10/1/46 | DB-2 | 1040
Initial Order 1 Unit—Re-ordered
25 units since original purchase
NAME* Leading Business Machine Mfr.
SHIPMENTS
DATE | MODEL NO. | SERIAL
6/30/52 | DB-200 | 445
Initial Order 1 Unit—Re-ordered
32 units since original purchase
NAME* Leading Appliance, Radio & T. V. Mfr.
DATE | MODEL NO. | SERIAL
12/4/46 | DB-8 | 1096
Initial Order 1 Unit—Re-ordered
36 units since original purchase
NAME* Large Chain & Sprocket Mfr.
SHIPMENTS
DATE | MODEL NO. | SERIAL NO.
7/28/51 | DB-400 | 259
7/28/51 | DB-400 | 260
Initial Order 2 Units—Re-ordered
24 units since original purchase
NAME* Leading Appliance & Electrical Equip. Mfr.
DATE | MODEL NO. | SERIAL
1/5/48 | DB-2 | 1172
1/5/48 | DB-2 | 1173
1/5/48 | DB-2 | 1174
1/5/48 | DB-2 | 1175
Initial Order 4 Units—Re-ordered
74 units since original purchase

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City _____ State _____

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Lear, Inc. pays particular attention to set up time — and to work positioning and holding operations. For here, they know important savings can be made. Here their own tool room ingenuity, plus Bellows "Controlled-Air-Power", has paid big dividends.

▲ *A few of the dozens of set ups at Romec Division, Lear, Inc. using Bellows midget air cylinder — the Han-D-Air. Only 4" long x 1½" square, its fast, automatic action saves production time in operating jigs and fixtures, positioning and clamping work, and ejecting finished parts.*

Lear, Inc. has built literally dozens of ingenious set ups using Bellows "Controlled-Air-Power" Devices. Set ups inexpensive to install, yet so flexible in design they can easily be transferred from one job to another — replacing slow, manual operations and cutting "idle" machine tool time. As a result of using Bellows Equipment, production increases range from 265% to 565%.

This story isn't unusual. It's typical of hundreds in our case history files — conclusive evidence that, no matter what you make, chances are Bellows "Controlled-Air-Power" can help you make it faster and at less cost.

May we send you a copy of our new bulletin "Faster, Safer, Better Production"? It's worth reading. Address The Bellows Co., Akron 9, Ohio, Dept. PMM-653.

In drilling a die cast aluminum pump body, Lear uses a Han-D-Air Cylinder to quickly clamp the work in position and a Bellows Drill Press Feed to automatically advance the drilling head. Synchronized to work together as a smoothly controlled team, these two units have jumped production from 100 to more than 300 parts per hour. ▼

The Bellows Co.
AKRON 9, OHIO
Bellows "Controlled-Air-Power" for Faster, Safer, Better Production

For additional information Circle No. 34 on the Reader Service Card

procedures[1] based upon treatment in alkaline solutions and the various phosphate treatments based upon treatment in acid solutions. Temperatures vary from 75F. to 180F. and immersion times from 10 to 20 minutes depending upon the procedure used. The acid treatments have the advantage of shorter times, but more expensive stainless steel equipment is required. The alkaline treatments, on the other hand, require only steel as a tank material.

Electroplating

Electroplating is a well known finishing system for other metals commonly used as die castings. Aluminum alloy die castings may be successfully plated if proper attention is given to the treatment of the surface prior to application of the electroplated coatings.

The successful commercial applications of electroplating are based upon the zinc immersion process or its various modifications. This simple chemical process removes the invisible ever present oxide film from the surface and replaces it with a film of zinc. This zinc film is extremely thin, and precautions must be taken in the application of subsequent electroplated layers so that it is not removed or destroyed in any manner.

Table 1 contains compositions of the standard sodium zincate solution and a recent modification which produces excellent results. The mechanism of the zinc immersion process is also shown.

Successful applications of copper over the zinc immersion film has been accomplished using the following copper plating method:

Copper Cyanide	5.5 oz./gal.
Total Sodium Cyanide	6.5 oz./gal.
Sodium Carbonate	4.0 oz./gal.
Rochelle Salt	8.0 oz./gal.
Free Sodium Cyanide (max.)	0.5 oz./gal.
pH	10.2-10.5
Temperature	100-110°F.
C.D.	12-20 amp. per sq. ft.

[1]**Alrok process, a trade mark of Aluminum Company of America.**

continued next page

CHEMICALS ACP PROCESSES

phosphate coating chemicals

TO MAKE YOUR PRODUCT DURABLE

PAINT BONDING

"GRANODINE"® forms a zinc-iron phosphate-coating bond on sheet metal products—automobile bodies and fenders, refrigerator cabinets, etc.—for a durable, lustrous paint finish.

"LITHOFORM"® makes paint stick to galvanized iron and other zinc and cadmium surfaces.

"ALODINE",® the new ACP protective coating chemical for aluminum, anchors the paint finish and protects the metal.

RUST PROOFING

"PERMADINE",® a zinc phosphate coating chemical, forms on steel an oil-adsorptive coating which bonds rust-inhibiting oils such as "Granoleum."

"THERMOIL-GRANODINE"® a manganese-iron phosphate coating chemical, forms on steel a dense crystalline coating which, when oiled or painted, inhibits corrosion.

PROTECTION FOR FRICTION SURFACES

The oiled "THERMOIL-GRANODINE" coating on pistons, piston rings, cranks, camshafts and other rubbing parts, allows safe break-in operation, eliminates metal-to-metal contact, maintains lubrication and reduces the danger of scuffing, scoring, galling, welding and tearing.

IMPROVED DRAWING AND COLD FORMING

"GRANODRAW"® forms on pickled surfaces a tightly-bound adherent, zinc-iron phosphate coating which facilitates the cold mechanical deformation of steel, improves drawing, and lengthens die life.

Send for descriptive folders and Government specifications chart on the above chemicals. Write or call for more information on these products, and advice on your own metal-working problem.

AMERICAN CHEMICAL PAINT COMPANY

General Offices: Ambler, Penna.

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Luster-on®

is the ideal "PAINT BOND" for your

ZINC DIE-CASTINGS

Applied in one quick dip

Manually or Automatically

Most uniform results

Most easily controlled

Lowest possible cost

Luster-on®

may be left as a final

COLORED FINISH

with excellent corrosion protection

Luster-on®

applied over buffed, zinc-plated die castings

RIVALS CHROME

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THE Chemical CORPORATION

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For additional information Circle No. 83

ALUMINUM FINISHES — cont.

Brass is also applied successfully over the zinc film by using the conventional brass plating solutions. Other metals may also be applied directly over the zinc film, but the procedure is more critical.

Barrel plating methods based upon the zinc immersion procedure are successfully being used commercially. Both still and barrel plating procedures must take into consideration the preservation of the zinc film. Most electroplating solutions will dissolve the thin zinc film; therefore, care must be taken that they are the right temperature and that the current is already applied to the rack holding the parts before it is immersed into the solution. This will assure minimum chemical attack on the zinc before deposition of the copper, brass, nickel, chrome or any other metal.

General recommendations are to apply a thin copper layer from the copper strike solution previously mentioned for best results. As stated before, most of the aluminum alloy die castings used commercially contain appreciable amounts of silicon which remain on the surface as a residual film after etching in alkaline solutions. For this reason, the etching and cleaning procedures recommended for preparing the surface prior to the zinc immersion film, contain fluorides and hydrofluoric acid or fluoride salts such as ammonium bifluoride.

Recent tests indicate that another procedure shows promise. This procedure is based upon a double immersion in the modified sodium zincate solutions. A flow sheet of the two procedures is shown in Figure 1. The double zincate procedure has the advantage of less attack on the surface; consequently, smoother deposits are possible and there is less danger of aggravating any porosity present in the casting.

Aluminum alloys containing high percentages of magnesium as an alloy constituent do not respond too satisfactorily to electroplating based upon the standard zinc immersion process. The results of recent tests indicate that substantial improvement results when using the modified sodium zincate solutions on the high magnesium alloys.

Exposure tests to determine the exposure characteristics of the conventional bright chrome system, particularly atmospheric exposure, are now in progress and preliminary results indicate that substantial improvement results when the modified sodium zincate solutions are used.

Commercial applications of electroplating vary from functional applications, such as hard chrome deposits for wear resistance and silver for con-

WOULD YOU LIKE MORE INFORMATION

about the materials, equipment and processes for finishing aluminum die castings? We will see that literature is sent to you by various producers of the items listed below if you circle the numbers on our Reader Service Card.

248. Buffs
249. Buffing machinery
250. Abrasive belts
251. Abrasive belt machinery
252. Barrel finishing materials and supplies
253. Alkaline surface treatments
254. Acid surface treatments
255. Electroplating equipment
256. Barrel plating equipment
257. Anodic coatings
258. Organic coatings
259. Paint application equipment and accessories

ductivity, to brass and bright chrome for decorative applications. Recent developments indicate the possibilities of a new system based on buffed "cold chrome" deposits on aluminum alloy die castings subjected to exposure at elevated temperatures such as sole plates for electric irons.

Anodic coatings

Anodic coatings are applied to aluminum alloy die castings for many purposes. The oxide coatings produced by anodizing are resistant to abrasion and corrosion and serve as an excellent surface preparation for paints, lacquers and enamels. These oxide coatings may be colored by dyeing with a suitable dyestuff or mineral pigmentation. In general, however, anodically coated die castings do not respond too satisfactorily to coloring. Aluminum Company of America has developed a variety of anodic treatments which are known commercially as Alumilite[1] finishes. These Alumilite finishes are applied for a number of applications. Alumilite black coatings are hard, smooth and will not chip or peel from the surface, as the coating is integral with the metal. Alloys such as Alcoa A214 and 218 are more satisfactory for the plain and colored Alumilite treatments. Although these alloys are better than the high silicon alloys for this type of finishing, perfect color match and uniformity of appearance should not be expected because of the possibility of revealing flow lines and "spotting out" caused by porosity.

The high silicon alloys respond well to Alumilite 705 and 710 treatments which provide excellent resistance to corrosion. The high silicon content of these alloys results in a dark gray finish. The flow lines are generally accentuated; therefore, the surface has a somewhat mottled appearance and is not very attractive for decorative applications.

continued on page 67

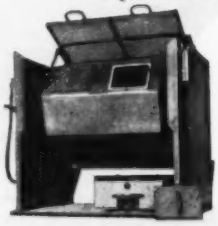
It's the Finish that Counts

ROTO FINISH

Roto-Finish COMPOUNDS AND CHIPS ARE MADE TO GIVE YOU THE PROPER FINISH ECONOMICALLY

There are other brands of materials that resemble Roto-Finish chips and compounds . . . but only Roto-Finish chips and compounds give you the *extra advantage* of continuous research by the company who originated the Roto-Finish processes. Roto-Finish chips and compounds are carefully manufactured so *you* obtain the best results on *your specific job*. To obtain the best results at the lowest cost . . . insist on ROTO-FINISH chips and compounds.

ROTO-FINISH puts your grinding, deburring descaling, polishing, britehoning or coloring operations ON A MASS PRODUCTION BASIS



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UNICHROME
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News about
COATINGS for METALS
Metallic . . . . . Organic . . . . . Decorative . . . . . Protective

How to Find The Right Finish for Zinc

RECTIFIERS WITH MANY ADVANTAGES FOR PLATERS

With Unichrome Rectifiers, platers are getting the benefit of a power supply designed for them. These units have more than the usual number of selenium plates to guard against overheating. Stack assemblies "float" with no rigid connections for protection against mechanical shock. Units are delivered completely assembled to save wiring headaches. They are conservatively constructed and rated, for longer life. They're protected against corrosion. And they are available now, in many outputs that permit *close* matching to current needs, thereby avoiding expense of extra capacity.

Formula for a chromium-bright lasting zinc finish

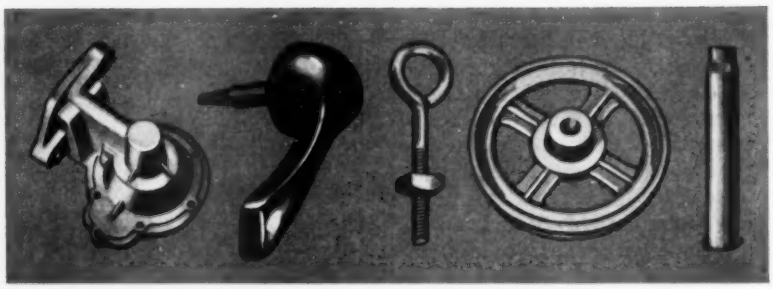
Here's the "substitute" finish that became standard for so many products because of its quality. First, a plate of .0002" to .0005" of zinc on the product. Then a quick dipping in Unichrome *Clear Dip* Solution for brilliance and corrosion resistance. Lastly, a Unichrome Clear Enamel which seals in the brilliance despite handling and exposure.

Copper platers doing smoother, faster work

In recent months, many plants have installed the Unichrome Copper Plating Process as they got into full swing again on copper plating. When it came time to increase capacity, new tanks also got Unichrome Copper. For obvious reasons. The bath plated fast. The deposits were smooth. Buffing costs were reduced because the finish buffed *easily*, if it needed buffing *at all*. The bath contains no cyanide.

UNITED CHROMIUM, INCORPORATED
100 East 42nd St., New York 17, N. Y.
Waterbury 20, Conn. • Detroit 20, Mich.
Chicago 4, Ill. • Los Angeles 13, Calif.
In Canada:
United Chromium Limited, Toronto, Ont.

Complete line of chromate treatments gives finishers greater control over type of process, color, costs and operating method



Improved chromate-treating methods have been largely responsible for the increased use of zinc as a finish in the past several years. For several reasons. They give zinc the extra protection against corrosion required by Government specifications. They can produce attractive decorative finishes. They provide a base for better adhesion of paint and lacquer.

Today, United Chromium offers metal finishers and designers the most complete line of chromate treatments available. This wide choice results in substantial benefits because it means a finish not "almost as good as" but rather the one that best meets the user's needs.

TWO WAYS TO PROCESS— DIFFERENT COLORS

By straight chemical conversion, Unichrome Dip solutions produce black, olive drab, brass-yellow, iridescent yellow or clear chromate coatings in 5 seconds to 2 minutes. The black and olive drab processes can produce finishes with the eye appeal of glossy enamel. Unichrome Dips use simple equipment, minimize installation costs.

The Anozinc* processes produce black, yellow or clear coatings *electrolytically*. These are tough, very economical finishes that can be handled while wet.

With both Anozinc and Unichrome Dip processes, the finish becomes an integral part of the zinc coating.

WHAT THE RIGHT FINISH MEANS

To a company treating zinc plated hardware, Unichrome Dip No. 95 means better "mileage" and a brighter, more corrosion resistant finish than formerly obtained.

To a plating superintendent, Unichrome Dip No. 98 means reduced costs, because he uses only half as much compound as before in make-up, and gets a solution with longer life.

To companies turning out zinc plated shell cases, Anozinc* means more economically producing a uniform, brassy protective finish inside and out. On a run of 26,000 20 mm cases, for example, one company got only 84 rejects.

To another user, Unichrome Dip 1081 —a *dry* compound—meant reduced shipping costs and fewer glass carboys to handle.

To a well known automotive supplier who replaced a "home made" chromate solution, Unichrome Dip No. 95 meant a 33% saving on materials cost alone.

In all cases, using a Unichrome process also means the service and experience of a United Chromium engineer who is often instrumental in ironing out users' operating problems.

SEND FOR SPECIFICATION CHART

A chart to save time and help locate the best-suited chromate-treating material is available. Also Bullein CC-1 describing Unichrome Dips and Anozinc. Write for your copies. **Trade Mark*

For additional information Circle No. 36 on the Reader Service Card

Recently there has been considerable interest in the new Alumilite Hard Coatings and Martin Hard Coatings for protecting surfaces against wear and erosion. Naturally, aluminum alloy die castings were considered for applications where these hard anodic coatings would be applied to give increased resistance to wear and erosion. Unfortunately, the most common alloys do not respond satisfactorily to these hard anodic treatments.

Almost all wrought aluminum alloys respond to anodic treatments in chromic or sulphuric to produce coatings that will meet this specification.

Careful consideration must be given casting alloys before they are anodically treated in chromic acid electrolytes, particularly die castings. Experience indicates that casting alloys containing appreciable amounts of silicon, 7 percent or more, do not respond satisfactorily to the chromic acid anodic treatment.

The current densities are abnormally high and in many cases actual anodic dissolution of the metal will take place. Under these conditions little or no oxide coating will be formed on the surface. In fact, the surface will be roughened and for many applications the parts will have to be scrapped because they will be undersize.

A modified procedure in chromic acid will sometimes produce better results, but the coatings still are not comparable to those produced on either A214 or 218 alloys. This modified procedure limits the voltage to 30 and the temperature to 90F. for 45 minutes. For best results, the aluminum alloy die castings should be anodically coated in sulphuric acid and then sealed in a boiling potassium dichromate solution. The sulphuric acid anodic process is much less critical in respect to alloy.

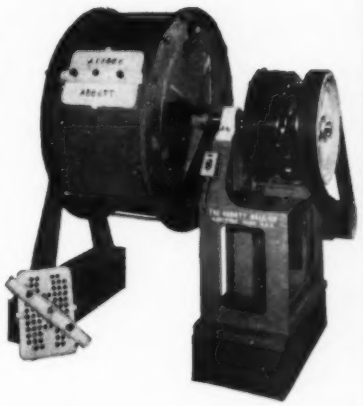
Organic coatings

Enamel and lacquers are practical systems for finishing aluminum alloy die castings and are used extensively for many commercial applications. All types of products are used depending upon the application. The polychrome and "wrinkle" enamels are very popular for the particular applications where die castings are involved. The gloss white enamels are, of course, the logical choice where aluminum alloy die castings are used for certain household appliance applications.

One of the most important considerations in the application of enamel or lacquer is the

continued on page 88

The ABBOTT METHOD



will do MOST of your BARREL FINISHING

Constant research and production line operations, developed and improved by Abbott engineers for more than forty years, conclusively PROVES that the Abbott Method of Barrel Finishing will efficiently perform most of your barrel finishing tasks.

The Abbott Method — originated by The Abbott Ball Company in 1910 — features the famous Abbott Vertical Barrel and Abbott's scientifically designed Burnishing Shapes.

For superior barrel finishing of stampings, castings and machined parts . . . investigate The ABBOTT METHOD.

Improved Abbott Barrel!

The famed Abbott Vertical Barrel — adjudged by experts as the most efficient in its field — has been improved! Self-contained, it features its own electric motor and speed control which gives precision control of barrel speeds at all times. Four basic barrel sizes in a combination to match any production requirement. Write for details . . . today!

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USE ABBOTT . . . THE SHAPE THAT COUNTS

ABBOTT

For additional information Circle No. 64 on the Reader Service Card

NEW PRODUCTS

For additional information on these products circle key number on reader service card bound in this issue.

AIRLESS BLAST BARREL
. . . available in several sizes

The airless Blastmaster Roto-blast barrel is now available in 3 and 18 cu. ft. capacity sizes in addition to 6 and 12 cu. ft. capacities previously manufactured.

Exclusive construction features include: a completely abrasive-tight door built of metal with laminated rubber backing; a heavy rubber curtain located between the door and the blasting area protects the door from flying abrasive and prevents castings from damaging the door.

The work conveyor drive has automatic torque throw-out arm protection to prevent damage to the equipment in case of jamming. Anti-friction bearings have been used wherever shafts carry loads. The non-pinch work conveyor built of continuous hardened steel roller chain never presents any openings to pinch the work. Individual slats of the conveyor are easily replace as they wear.

Centralized controls and continuous cleaning and reclaiming system are two other special features.

Pangborn Corporation
For more information Circle No. 196 on the Reader Service Card.

UP TO 1200 PER HR.
. . . on automatic painting unit

New-type automatic, rotary-indexing painting machine can be controlled by dial to paint from 400 to 1200 pieces per hour, two at a time.

May be completely air-operated or actuated by electric-motor Geneva drive. Machine illustrated has 24 work-holders & indexes 12 times per each revolution of the table, painting the inside of rocket heads 2 at a time. Machine also built for 4-, 6-, 8-, or 24-station indexes or for continuous movement.

The part being painted in illustration has cavity 8″ deep and painting is accomplished on return stroke, with work revolved by variable speed air drive. Speed of stroke during painting can be regulated by dial.

The machine operates in conjunction with a continuous, circulating paint system and, if required, can be supplied with hot spray equipment.

Conforming Matrix Corporation
For more information Circle No. 197 on the Reader Service Card.

TUMBLE-DEGREASING
. . . with cellulose fibre

Finely ground cellulose material with exceptionally high absorbency, called Cottontex is available for use in degreasing and drying operations employing tumbling barrels.

The material is said to absorb more than 8 times its own weight of oils, greases or any liquid from metals, plastics or composition. Especially useful for degreasing small castings, ball bearings, needle bearings, etc.

The material is light in weight, economical, fast-acting, and soft so as to protect

parts during tumbling. Sample sent on request

Cottontex Mfg. Company
For more information Circle No. 202 on the Reader Service Card.

VACUUM DIE CASTING METHOD . . . with modified cold chamber machine

Using a modified cold chamber type die casting machine, Alfred P. Federman has announced a new method for die casting within a vacuum to produce castings that are substantially free of porosity. By this technique, the die cavity is evacuated ahead of the metal injection, thus removing air which might be entrapped.

Mr. Federman will use the process to produce aluminum die castings commercially, concentrating on problem castings where sound metallurgical structure and freedom from porosity are difficult to attain by the conventional methods.

He claims that the machine will be useful for producing rotors for electric motors where aluminum is injected through stacked laminations. Absence of porosity is expected to improve electrical properties and provide uniform balance. Other applications include pump and hydraulic components. Up to 3 lb. of aluminum can be cast per shot, with gate and sprue.

For more information Circle No. 199 on the Reader Service Card.

THREE AIR CLAMPS . . . added to line of cylinders

Three new air clamps (spring return air cylinders and two new air valves) have been added to the Mead line of air-operated cylinders.

New cylinders are: Model H-71, power factor 7 times line pressure, stroke 1" and bore 3"; Model H-72, power factor 7 times line pressure, stroke 2" and bore 3"; Model H-73, power factor 7 times line pressure, stroke 3", bore 3".

New air valve replaces lever control with a button mounted directly on valve plunger to be actuated by operator's palm or fist. Full 5/16" openings throughout; hose nipples fit 3/8" ID hose.

Mead Specialties Company
For more information Circle No. 203 on the Reader Service Card.

HIGH SPECIFIC GRAVITY . . . in new tungsten alloy

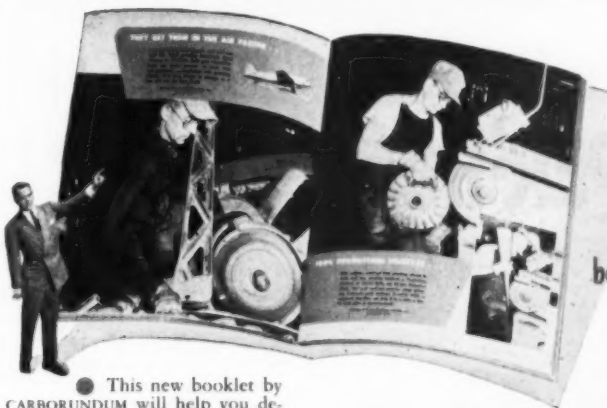
With a specific gravity about 50 percent higher than lead, a new non-cutting grade of tungsten alloy is being produced and marketed. The new material is being used extensively for shielding against radioactive rays in atomic energy work and other applications requiring similar types of shielding.

In addition to its use as a shield the new metal has found extensive use for static and dynamic balancing as well as other uses where a maximum amount of weight in any given space is required.

Metal Carbides Corp.
For more information Circle No. 200 on the Reader Service Card.

continued next page

How to STEP UP PRODUCTION
with CARBORUNDUM's Abrasive Belts



This FREE booklet shows you how!

● This new booklet by CARBORUNDUM will help you determine what grinding jobs you may be able to do better with abrasive belts...and give you the facts you need to make your present belt grinding operations more profitable.

Actual case histories—complete with photographs, facts and figures—show you the way many companies have increased production and lowered costs by switching to CARBORUNDUM's abrasive belts and contact wheels. In some cases the change was to belts from grinding wheels or set-up wheels; in others, the change was made from other types of belts and contact wheels to those by CARBORUNDUM.

USE THE COUPON ▶ to send for your copy today. And call your CARBORUNDUM distributor or salesman—he's ready to help you step up production, cut costs.

THE CARBORUNDUM COMPANY, Dept. PM 82-316
Niagara Falls, New York

Please send me a copy of "Abrasive Belts by CARBORUNDUM."

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COMPANY _____

STREET AND NUMBER _____

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CARBORUNDUM TRADE MARK

...the ONLY source for EVERY abrasive product you need

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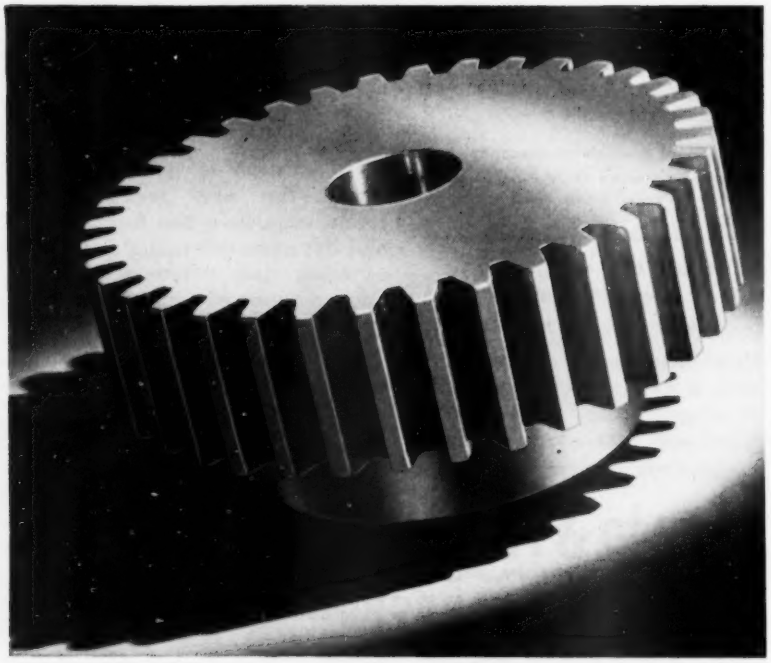
82-816A

For additional information Circle No. 85 on the Reader Service Card



High lustre finish... faster with

SUPER-HONITE CHIPS!

YES! New Super Honite gives a better finish —*faster*—than any other barrel finishing abrasive. That's because it's the world's *toughest* abrasive chip—engineered for grinding and burnishing to a high luster finish. Does it in jig time, too, because chips don't crumble or pulverize to slow the job.

So remember, for a better finish—in record time—specify Super Honite. No other chip cuts faster—no other chip cuts as long!

TOUGHEST NATURAL CHIP! Use Regular Honite for close tolerance work or minimum removal of metal. No other barrel finishing abrasive—not even granite—retains its edge as long as Regular Honite.

WRITE TODAY for your free copy of "3M Barrel Finishing" . . . it's filled with helpful information for increased efficiency, lower costs. Address Minnesota Mining & Mfg. Co., Dept. PM 63, St. Paul 6, Minnesota.

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Company.....

Address.....

City.....Zone...State.....

Honite BRAND

Made in U.S.A. by Minnesota Mining & Mfg. Co., St. Paul 6, Minn.—also makers of "Scotch" Brand Pressure-sensitive Tapes, "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing, "3M" Abrasives, "3M" Adhesives. General Export: 122 E. 42nd St., New York 17, N. Y. In Canada: London, Ont., Can.

For additional information Circle No. 50 on the Reader Service Card

SILICONE RELEASE AGENTS . . . for shell molding process

Silicone release agents for preventing shells from sticking to the patterns are offered. Silicone agents form a heat-stable and economical parting surface between pattern and shell.

Silicone agents are reported to be incompatible with most organic materials and noncorrosive to metals. They cannot break down at molding temperatures to form a carbonaceous deposit on the mold or pattern. They wet and adhere to metal surfaces and do not alter permeability of the shell. They are easily applied and effective as an immeasurably thin film.

Series of compounds and emulsions are offered, along with detailed instructions on application.

Dow Corning Corporation

For more information Circle No. 206 on the Reader Service Card.

AIR & LOW PRESSURE . . . cylinders with bore 1½" to 14"

Complete line of air and low-pressure hydraulic cylinders with bore sizes from 1½" to 14" and standard stroke length up to 84" have been introduced

Cylinders are heavy duty type featuring square heads machined from steel. Dirt-wiper seals and high tensile stainless steel piston rods are features. Barrels are drawn seamless brass. Piston cups employ oil-resistant composition material.

Self-regulating gland packing forms a leakproof seal ahead of a bronze piston rod bearing. Standard mounting brackets include leg or foot mounting, front or rear flanges, clevis mounts, pivot ends. Cylinders available cush-

continued on page 73

SIZE IDENTIFIED ASSEMBLY SIMPLIFIED

The Only

SIZE-MARKED GEAR GRIP SOCKET HEAD CAP SCREW

The size is clearly incised on the head, can be seen at a glance. It prevents errors by "green" workers, helps veterans also to speed assembly. It saves time and wasted screws when sizes get mixed up.

It's a sales feature for your product. Your customers' maintenance men will like the Size-mark . . . it aids them in reassembling after servicing. Gear Grip prevents slips, speeds work, even when fingers are oily.

Since there is no better Socket Head Cap Screw made, why not get these important extra features offered only by P-K? Ask for samples. Parker-Kalon Corp., 200 Varick St., New York 14, N.Y.

FOR ANY TYPE SOCKET SCREW—
REMEMBER

IF IT'S P-K IT'S O.K.
TRADE MARK REG. U.S. PAT. OFF.

PARKER-KALON®

Sold through Industrial Distributors, the Supply Specialists that serve you

Cold-forged **SOCKET SCREWS**

CAP FLAT HEAD BUTTON HEAD SHOULDER SET HEX KEYS

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ioned at rod end, at rear end, or both. Double rod end cylinders are also featured.

James L. Entwistle Company
For more information Circle No. 198 on the Reader Service Card.

MASS INSPECTING CASTINGS . . . with industrial fluoroscope

Fluoroscope for mass inspection of light alloy die, permanent mold or sand castings has been introduced. It is called the Scopemaster and is also useful for mass inspection of concealed assemblies, hydraulic, mechanical or electrical components, and for guidance of new-product development.

Of particular interest is the mechanism for moving the product in the x-ray beam on a special turntable. A single external control handle permits moving of parts to be inspected in any lengthwise or crosswise direction while in the x-ray beam.

In the case of castings, this facilitates inspection of fillets and corners. The distances between receiving screen and the product part may also be adjusted during inspection.

The unit provides 100% inspection of critical castings. Unit operates on 110 v 60 cycle source has; 9x19" front opening; internal cavities .040 in size of approx. 6% of the metal thickness in aluminum alloy casting, can be detected.

General Electric Company, X-Ray Dept.
For more information Circle No. 204 on the Reader Service Card.

RUBBER-CUSHIONED ABRASIVES . . . in three new textures

New series of rubber cushioned abrasives round out the Brightboy line, hitherto made in Standard, Tuff-Tex and Fine-Tex. New series, known as Brightboy BL series, is made in coarse, medium and fine; all are made in variety of sizes in wheels, discs, sticks, rods, cylinders, tablets and blocks for manual or machine.

Feature is new rubber binder compounded with the abrasive grain. Manufacturer reports many new uses for burring, metal finishing, polishing, and blending.

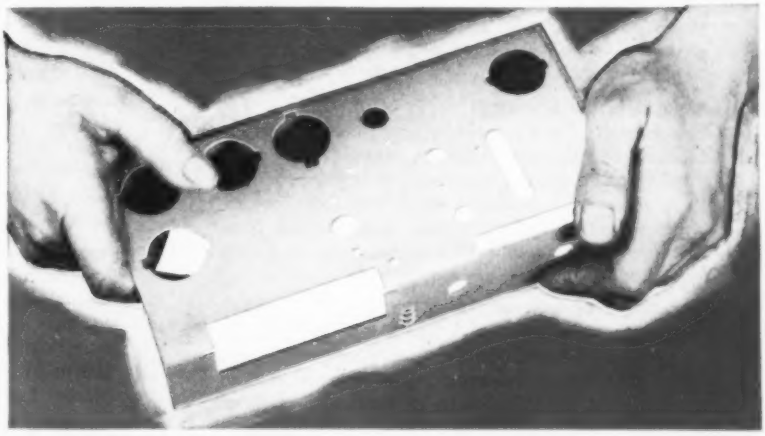
Brightboy Industrial Div., Weldon Roberts Rubber Co.
For more information Circle No. 205 on the Reader Service Card.

VERTICLE SPINDLE GRINDER . . . with cup wheel

A new surface grinder utilizing a vertical spindle and a cup wheel has been brought out. Roughing cuts can be made rapidly, by hand, as the work is held on the table by either clamps or a magnetic chuck; for the finishing cut, an hydraulic feed is engaged.

Vertical adjustment of the spindle is by means of a hand wheel for coarse adjustment. A calibrated drum reading to 0.0004 controls the fine vertical adjustment. The machine uses standard 7½ inch diameter cup wheel. Grinding can be done either wet or dry and a coolant tank and pump are incorporated in the machine.

George Scherr Co., Inc.
For more information Circle No. 201 on the Reader Service Card.



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Water Dip #33 has many **more** advantages — in many **types** of plating. For the complete story, write for Technical Data Bulletin #117 or let our **M & W** technical consultant discuss your requirements privately with you.

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Midwest Div.: 1650 Carroll Ave., Chicago 12, Ill. • Pacific Coast Div.: Smith-Davis Co., 10751 Venice Blvd., Los Angeles 34, Cal.

MANUFACTURERS OF INDUSTRIAL FINISHES

For additional information Circle No. 87 on the Reader Service Card

USEFUL LITERATURE

To receive copies of the publications described here circle key number on reader service card bound in this issue.

PROCESSES

New Investment Casting Foundry 144
The investment casting facilities of the Misco Precision Casting Co. are described in a reprinted article. Process control and special equipment are included.

Advantages & Applications of Powder Metallurgy 145
In a 40-pg thoroughly illustrated book, United States Graphite Co. offers a comprehensive exposition of the powder metallurgy process and shows many typical uses. Design data on various grades of sinterings produced by the company are included.

New Producer of Sinterings 146
Powdercraft Corp., recently organized plant to produce metal sinterings, has issued a brochure showing some typical structural parts and standard sizes of porous bushings they will manufacture. Structural parts include copper base & iron base machine parts, metallic friction materials and mettallic filters.

Engineering Properties of Sinterings 147
In a folder from General Powdered Metal Products Inc. are given typical applications & physical properties of sinterings the company produces. Ultimate tensile, yield point, modulus of rupture and other data are given for 6 different types of sintering.

MATERIALS & EQUIPMENT

Carbide Dies for Powder Pressing 150
Facilities of the Aviation Tool & Gauge Co. for manufacturing carbide tools & dies for the powder metallurgy, plastics and metal forming industries are listed in a brochure recently made available.

Electronic Temperature Controllers 151
Temperature control instruments made by Wheelco Instruments Div., Barber-Coleman Co., are described in a new bulletin on their Capacitrols. These instruments are milli-volt meter type suitable for on-off control, anticipating & proportioning, and general temperature control work.

Low Oxide Metal Powders 152
The line of metal powders manufactured under the trade name of Resistox by the Glidden Co., are described in a brochure and several bulletins. These specially low oxide grades of powder are reported to give more uniform sinterings.

Metal Powder Bulletin Published Again 153
After a lapse of several years, Metals Disintegrating Co. has started publication of its house organ, The Drum, again. It deals with applications & testing of metal powders.

Molybdenum Disulfide Lubricant 154
Properties & uses of molybdenum disulfide as a solid lubricant are detailed in a technical report published by Alpha Corp. The report is a reprint of a paper presented before the American Society of Lubrication Engineers & covers chemical stability, electrical properties, purity, anti-corrosion properties, thermal stability, coefficient of friction & methods of application.

Pantograph Engraving & Duplicating Machine 155
In a 10-pg illustrated catalog, the Mico Instrument Co. describes its line of pantograph type engravers & duplicators for two & three dimensional reproduction.

Domestic & Imported Machine Tools 156
A new catalog of machine tools & accessories has been completed by the Morey Machinery Co. This catalog consists of 180 pages of domestic & European machine tools, as well as a comprehensive showing of accessories for turret lathes.

Filters for Hydraulic Oils, Coolants & Lubricants 157
Incorporated in a new 12-pg catalog is information about Marvel Synclinal filters for hydraulic oils, coolants & lubricants. Drawings, parts lists, dimensional charts, engineering data & typical installations are given in the catalog available from Marvel Engineering.

Standard & Specialized Hand Tools 158
Publication of a new 128-pg catalog covering the complete line of their tools, has been issued by Cornwell Quality Tools Co. Illustrations & detailed descriptions provide complete data on standard & specialized wrenches, screwdrivers, drills, saws, punches, sensory torque wrenches, spring testers & reamers.

FINISHING

Abrasive Belt Grinding 165
A book containing 46 case histories on abrasive belt grinding entitled "Where There's Industry" has been issued by Porter-Cable Machine Co. Finishing of die castings is illustrated.

Rotary Files, Cutters & Carbide Tools 166
R. G. Haskins Co. offers an 8-pg. brochure listing the company's standard rotary files, burrs, cutters & carbide tools designed for pattern & die work.

Grinding Wheel Safety Data 167
Four booklets aimed at the safe mounting, handling, storing & use of grinding wheels are available through the Norton Co. Books were prepared by the Grinding Wheel Institute & include American Safety Standard Code for use, care & protection of abrasive wheels.

Preparing Aluminum for Plating 168

The Alumon process for preparing aluminum to be plated is the subject of literature from Enthone Inc. The process requires only cleaning, an acid dip and a proprietary dip before plating, after which any standard plating procedure is said to be suitable.

Industrial Finishing Facilities 169

A pair of brochures have been published by the Simmons Plating Works describing their facilities for industrial finishing. Also listed are the best uses and features of several electroplated finishes including chromium, zinc, cadmium, tin & silver.

Plating Baths 170

A condensed description of zinc, cadmium, copper & white alloy plating baths has been issued by Promat Div., Poor & Co. Also described are secondary chromate treatments to make magnesium, aluminum, zinc & cadmium surfaces more corrosion-resistant.

Recommended Buffing Compounds 171

A 6-pg report from Globe Compound Co. describes that company s line of buffing compounds and recommends compounds for a wide variety of metals, using both manual & automatic machines. Cutting down & coloring are covered.

Gold Color on Aluminum 172

A Swiss development for coloring aluminum in all of the usual colors as well as gold and siver is being marketed in the United States by Miracle Finishes, Inc. The process is reported to be similar to anodiz-

continued next page

For additional information Circle No. 92 on the Reader Service Card

High Speed "Controlled Tapping"

Save Taps . . . Stops Spoilage

"Controlled Tapping" is the nearest to automatic tapping perfection yet developed! AND users of Procunier tapping heads have been enjoying this advantage for many years. It is made possible by a unique exclusive clutch design which operates with a smooth, sensitive "cushioned action." The tap driving power is automatically regulated by the pressure applied thru the drill press spindle. Large or dull taps require more pressure and driving power than smaller, sharper ones — and "green" as well as experienced operators can quickly detect dull or loaded taps by the "feel" or pressure applied. The acute sensitivity of the clutch results in less tap breakage, fewer spoiled pieces and makes it easier to maintain high production schedules and output.
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New TRU-GRIP Tap Holder is lighter, smaller in diameter. It affords easier tapping close to walls or shoulders, eliminates "chewed" tap shanks.

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Chicago 6, Ill. Dept. S

Gentlemen: Please send your illustrated brochure giving complete details, specifications and prices on the improved line of Procunier High Speed Tapping Heads.

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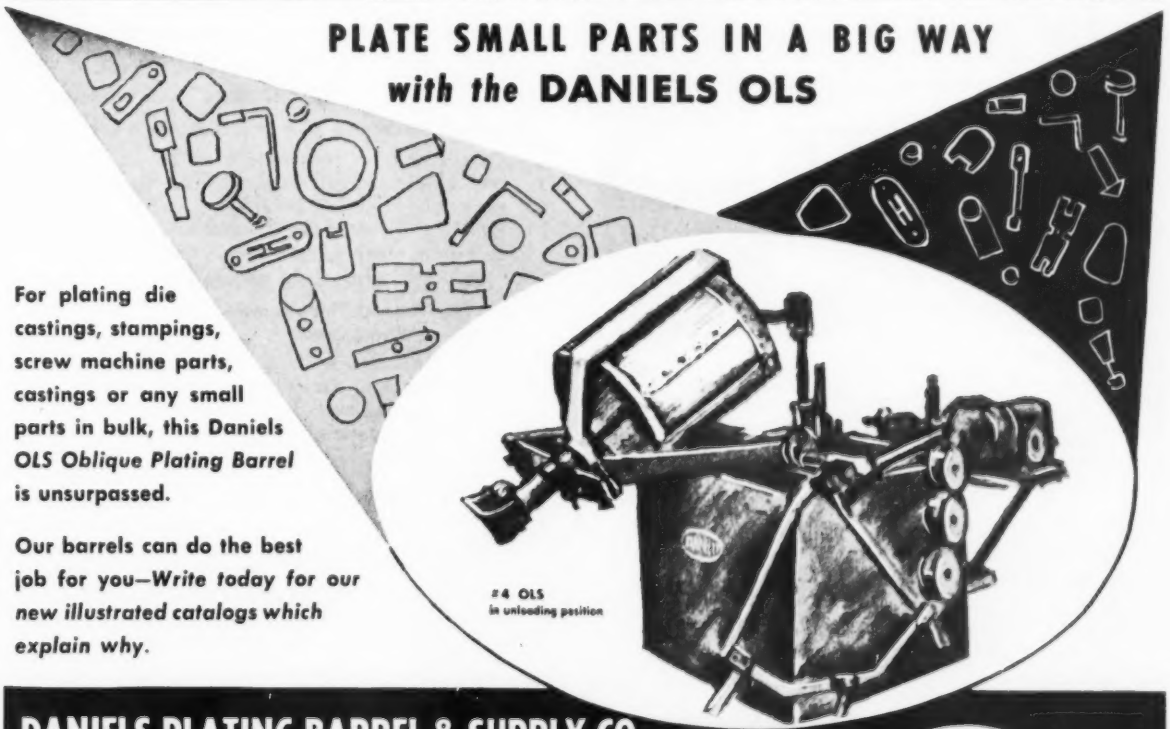

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DANIELS

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DO REJECTS SLOW UP YOUR PRODUCTION LINE?

OAKITE PAINT STRIPPERS MAY HELP YOU BREAK THE BOTTLENECK

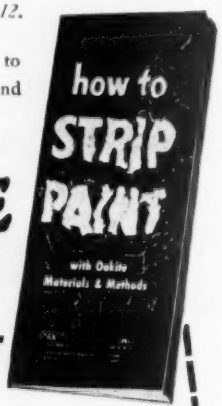
When painting rejects slow production, you may need one of the stripping methods described in "How to STRIP PAINT", a free booklet which answers many questions about effective stripping procedures. For example:

¶ What's the best way to strip paint from metal parts too large to be soaked in tanks? *See page 3.*

¶ What is the cheapest way to strip metal parts in large volume? *See page 9.*

¶ What strippers are best for removing oil-base paints? . . . Synthetic enamels, alkali-resistant plastics or resin-base paints? . . . Japans, wrinkle finishes, nitrocellulose lacquers, alkyds, phenolics and ureas? *See page 12.*

FREE For a copy of "How to STRIP PAINT" just send us the coupon.



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Company _____

Address _____

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USEFUL LITERATURE — cont.

ing, but less expensive than either electroplating or anodizing. The process is suitable for most articles fabricated from aluminum except castings. Descriptive literature is available from the distributor.

Protective Coating for Bare or Painted Metal 173

Steelast products, a new line of protective coatings developed by the Steelcote Mfg. Co. are fully described in literature available from the manufacturer. The new coatings can be sprayed, dipped, or brushed and come in either clear or a variety of colors. The coating is said to withstand wet heat up to 180F or dry heat up to 300F.

Lower Corrosion Rate 174

In order to secure a better adhesion of paint to metal surfaces and, at the same time, sharply decrease the rate of corrosion of such metals as steel, Thompson & Co. have developed a new Vinsynite pretreatment for all metals, described in a six page folder.

Short Cycle Phosphate Coating 175

Designed to meet government specifications with only a one to two minute processing cycle, the Keykote process developed by Kelite Products, Inc. is described in detail in literature and data books available.

Adjustable Spray Mask Fixture 176

A new line of paint spray mask fixtures are described in a brochure available from Finish Engineering, Inc. The fixtures will handle masks up to 30 inches long and utilize from two to four air pistons for clamping and holding.

One Bath Blackening of Iron & Stainless Steel 177

Operating at a temperature of 255-260F, a one bath blackening process for stainless steel, cast and malleable irons has been developed by Mitchell-Bradford Chemical Co. Complete details are available from the supplier.

Protecting Tapped Threads with Coiled Wire Inserts: 178

A bulletin from Heli-Coil Corp. explains how wire thread inserts of stainless steel or phosphor bronze protect tapped threads in die cast metals, plastics and other materials.

Rosen Core Solder 179

A new 4-pg bulletin from American Smelting & Refining describes a new rosin core solder known as RTS 200. The bulletin describes 5 ways in which the new solder is superior to other rosen core solders, including faster spread, faster oxide penetration and other features.

Metallurgical Microscopes in Brochure 180

Complete line of Cooke metallurgical microscopes is presented in a new 6-pg brochure from R. Y. Ferner Company. Of special interest are the Cooke incident light phase contrast equipment and the Cooke Universal Illuminator.

PLATING WASTE TREATMENT BY ION EXCHANGE

Treatment of electroplating rinse waters by ion exchange has been one of the most attractive methods considered in recent years for the elimination of very serious water pulution problems.

Economic aspects for the recovery of scarce metals and a discussion of a new process for the recovery of cyanide from cyanide plating rinse baths were explained in a paper delivered by C. F. Paulson, Special Applications Engineer, The Permutit Company, New York, N. Y., before the Purdue Industrial Waste Conference at Purdue University recently.

According to Mr. Paulson, the most successful of the ion exchange processes applied to electroplating waste recovery has been the use of cation and anion exchangers in the recovery of chromic acid. Additionally, the anion exchange process has recently been extended to the treatment of mixed chromate rinse water.

ADDENDA FOR 2ND ANNUAL POWDER METALLURGY DIRECTORY

The following company names should be added to the 2nd Annual Directory of Powder Metallurgy presented in the April 1953 issue of Precision Metal Molding:

COPPER POWDER

Malone Metal Powders, Inc.
220 W. 42nd. St.
New York 36, N. Y.

STEEL POWDER

Vanadium Alloys Steel Co.
Latrobe, Pa.

MAGNETIC MATERIALS (cores)

National Moldite Co.
1410 Chestnut St.
Hillside, N. J.

Pyroferric Co.
621 E. 216 St.
New York, N. Y.

STRUCTURAL PARTS

Indar Corp.
Indianapolis, Ind.

United States Graphite Co.
Saginaw, Mich.

BEARINGS

Indar Corp.
Indianapolis, Ind.

United States Graphite Co.
Saginaw, Mich.

high corrosion resistance
paint base
bright finishes
final finishes
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TODAY for finishing ZINC, CADMIUM, ALUMINUM, CUPROUS METALS
WANT CORROSION RESISTANCE? Iridite will give you better-than-specification protection against corrosion.
WANT PAINT ADHERENCE? Iridite provides a firm and lasting base for paint by preventing under-film corrosion.
WANT EYE-APPEAL? Iridite can give you a variety of finishes, depending upon the metal being finished . . . from clear and sparkling bright or military olive drab, to attractive dyed colors.
BEST OF ALL, any Iridite finish is economical and easy to apply.
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REDUCES NEED FOR ANODIZING
Simple chemical dip; immersion time only 10 seconds to 2 minutes; no sealing dip; color is clear or yellow depending upon your requirements; salt spray resistance equivalent to 20 to 30 minutes of anodizing, eliminates need for costly racks and electrical power.
WANT TO KNOW MORE? Write for literature and send production samples for free test processing. See "Plating Supplies" in your classified telephone directory or write direct.
Iridite is approved under government specifications.
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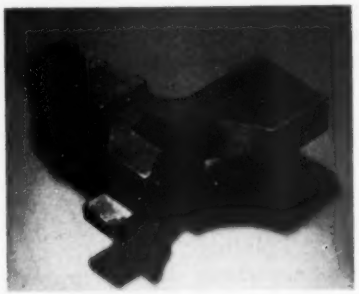
continued from page 41

machine tool time and the labor of highly skilled workmen. This was obviously unsatisfactory when the machine reached full scale production.

One of the more complex of these machining operations is presented graphically in Figure 4. It reveals the six stages of machining a distributor box clutch pawl. Two clutch pawls are cut from a hollow, tubular shape having stepped inside diameters and tapered outside diameter.

This complex shape, with its cam surfaces and extended wings is now investment cast in tool steel, and requires only the drilling of a cross hole. This is typical of the use of an investment casting to short cut hours of expensive machining. Initial tooling costs for such a casting are amortized over a relatively short production run, paying for itself many times over for pieces of stable design.

The investment cast clutch pawl is included in a group of investment cast components, Figure 5. Each of these pieces represents a saving in money, time and materials. These castings, and the one in Figure 6, are produced for Intertype by the Investment Casting Company and by Austenal Laboratories' Microcast Division.



6. THE NUMBER OF MILLING operations that would be required for this piece if it were not investment cast would be extreme.

Investment castings are now being used for a variety of small machine parts in the Fotosetter machine. Two of the more interesting castings included in Figure 5 are the brush holder (b) and alternating wheel (c).

The brush holder is cast in a beryllium cop-

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Ask any man who has worked with our product and he'll give you a dozen reasons in five minutes why he wouldn't use any other. Try it and be convinced.

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per alloy. The casting has a dovetail slot across its top surface. The nylon brush is set into this slot and the inner ends are melted to form a solid block in the dovetail slot, thus making a permanent assembly. The investment casting comes from the caster with all dimensions ready for assembly.

The alternating wheel is a highly complex piece. At one time, this was assembled from machined pieces, since there are cam surfaces at top and bottom and at ratchet-like circumference. The wheel is now investment cast in tool steel, and requires only the facing, drilling and reaming of the central hub, all of which can be performed with a single setup.

Largest of the investment cast pieces is the delivery slide head in Figure 6, cast in mild steel. It weighs about 12 ounces. This is an extremely complex shape which could only be fabricated by many milling operations on every surface. The number of fixtures and individual machine setups would be prohibitively expensive; tooling for the investment casting is considerably less expensive and results in the production of a completely finished component as cast.

Investment casting is not a cure-all, but it has offered these builders of highly specialized machinery a solution for fabricating some of the most awkward shapes. It has saved the company's machine tools for other work in which setup is simpler or production quantities higher.

H-P-M OPENS MANUFACTURING CENTER IN EUROPE

The Hydraulic Press Mfg. Co. of Mt. Gilead, Ohio, has announced a new manufacturing center abroad which will produce the full line of H-P-M equipment for distribution in Western Europe and territories. The complete line of all-hydraulic presses, die casting machines and plastic molding presses will be produced.

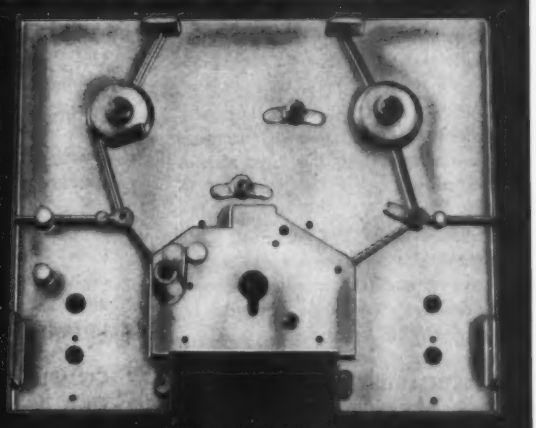
Complete sales, service and manufacturing facilities will be coordinated through Hydrulische Pers Maatschappij Nederland, N.V., a wholly-owned company subsidiary with headquarters at 558 Keizersgracht, Amsterdam. Manufacturing facilities have been established with GFBR Stork & Co., N.V., Hengelo, Netherlands. It is one of the largest and most modern plants for manufacturing heavy machinery in Europe, and has more than 8,000 employes.

Officers of the new corporation are: G. B. Robinson, Chairman of the Board; John C. Cotner, President; John M. Dolan, Vice President; and George A. Daniels, Secretary-Treasurer. W. M. Truska, of the Home Office Sales Organization, has been appointed European Sales Representative.

Light Metals for Portability

Tape Recorder Mechanism Plate Die Cast in Aluminum or Magnesium

WILCOX-GAY TAPE RECORDIO



When minimizing weight is required, aluminum and magnesium alloys meet the need. However, these new lightweight metals offer other most important advantages. When they are die cast they effect other great savings. For example The die cast mechanism plate for the Wilcox-Gay Portable Tape Recordio shown, features on its underside (illustrated above) bosses for mounting electronic and mechanical parts with bearings, recesses and holes cast in the plate in a single operation. You can see at a glance how much labor-time the manufacturer has saved by having this part die cast — also, machining, finishing and assembling has been virtually eliminated. Savings such as these aid considerably in competitive selling.

Let's Talk It Over . . .

LITEMETAL DICAST, INC. is an organization of specialists — men thoroughly experienced in the casting and machining of magnesium and aluminum alloys. Our equipment includes big machines for big jobs — little machines for little jobs . . . the right sizes and types of the most modern die casting equipment for producing parts from the size of a button to large cable spools. Complete facilities for secondary operations are also available.

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Quick action on inquiries.

LITEMETAL DICAST, Inc.

A DIVISION OF HAYES INDUSTRIES

1925 WILDWOOD AVE. · JACKSON, MICHIGAN

PLANT AND EXECUTIVE OFFICES

REFERENCE MATERIAL

Catalogs and data offered free in this month's ads; to receive copies circle number on reader service card.

2. HYDRAULIC PUMPS that reduce fire risk and cut fluid costs in die casting machines are reported in Aldrich Pump catalog.

3. PRECISION CASTINGS from frozen mercury patterns described in bulletin from Alloy Precision.

10. DIE CASTING MACHINE specifications are in catalog from Cleveland Automatic Machine.

12. NEW FEATURES and improvements in die casting machines are detailed in the Cast-Master catalog.

13. MINIATURE OR LARGE die castings, whichever you need, are described in the General Facilities Bulletin offered by the Dollin Corp.

15. DIE CASTING BY HOOVER is an informative booklet about the facilities of Hoover's die casting plant.

17. DIE CASTING MACHINES from Hydraulic Press Mfg. Co. are described and illustrated in a specification catalog.

19. SAFE OPERATING TEMPERATURES for hydraulic fluids in die casting machines with heat exchangers discussed in Kewanee-Ross booklet.

21. DIE CASTING MACHINES of many sizes & capacities are presented in a catalog from Kux Machine Co.

23. NON-FLAMMABLE FLUID for die casting machines reviewed in 12-pg booklet on Pydraul F-9 from Monsanto.

27. CLOSE-UP OF DIE CASTING is title of informative brochure from Pressure Castings.

31. NEW CASTING METHOD using frozen mercury patterns, is covered in an 8-pg booklet for product designers. Offered by Metallurgical Products Div. of Thompson Products, Inc.

32. REVISED EDITION of 22-pg booklet on barrel finishing methods has up-to-date information from Almco Div., Queen Stove Works.

34. USING AIR CYLINDERS to speed up machining operations is the subject of a comprehensive bulletin from Bellows. It includes specifications, diagrams and engineering data.

36. A CHART TO SAVE time and help locate the best-suited chromate-treating material for zinc die castings is offered by United Chromium, Inc.

37. COMPLETE PRODUCT DIRECTORY, listing all available forms of beryllium copper is offered free by the Beryllium Corp.

41. POWDERED METAL PARTS facilities of Michigan Powdered Metal and some of the company's products are covered in a bulletin.

42. HOW TO CUT die casting finishing costs by the use of Velvaglazed aluminum castings is the subject of a bulletin from Monarch Aluminum.

43. DIMENSIONING DIE CASTINGS, a reference manual, is offered by Newton-New Haven.

44. DIE DESIGNING SERVICE for die castings is fully explained in illustrated brochure from Permanent Mold Die.

45. POWDERED METAL GEARS, both standard and special, are the subject of literature from Powdered Metal Products Corp. of America.

48. IRIDITE PROTECTIVE systems for corrosion-resistant metal surfaces are outlined in brochure from Allied Research Products.

49. METAL PRESERVATION and paint adhesion with chemical treatments produced by American Chemical Paint Co., are described in technical literature.

50. BARREL FINISHING methods and equipment are comprehensively outlined and illustrated in brochure from Minnesota Mining.

51. PRECISION BARREL FINISHING techniques are reported in detail by Roto-Finish.

53. ALUMINUM & ZINC die castings produced by Advanced Tool & Die Casting Co. are introduced in new booklet.

56. SMALL DIE CASTINGS — review of size, alloy and design limits in a folder from Gries Reproducer. Also includes sample castings.

57. ALLOY SUPPLIERS, Henning Bros. & Smith, offer monthly house organ called the Henning Messenger.

60. HOW TO DESIGN aluminum and magnesium die castings is subject of data book from Litemetal Dicast.

64. IMPROVED TUMBLING UNIT is reported in new literature from Abbott Ball describing Abbott Method of barrel finishing.

65. USING ABRASIVE BELTS to step up production is the subject matter of a new booklet from Carborundum.

66. PLATING BARRELS and auxiliary equipment are covered in catalog from Daniels Plating Barrel Co.

67. WATER dip to protect copper-plated parts from finger prints and stains, is subject of data sheets from Maas & Waldstein.

68. HOW TO STRIP PAINT is the subject of an informative bulletin from Oakite.

69. ALLOYS FOR INVESTMENT casting are described in literature from Cannon-Muskegon.

74. ELECTRIC MESH BELT furnaces for continuous sintering of powdered metal parts are presented in detailed information from Harper Electric.

77. MAGNETIC IRON POWDERS are discussed in technical literature offered by Magnetic Powders.

79. STANDARD BEARING LIST is subject of literature from National Molded Products.

82. LIGHT WEIGHT LADLES of stainless steel for die castings are introduced in an informative bulletin from Spincraft.

83. ZINC PLATE with chemical passivating dip for brilliant chrome-like finishes is covered in data sheets from Luster-On.

84. PERMANENT MOLD and sand castings are subjects of an illustrated brochure from Aluminum Permanent Mold Co.

85. ROCKING ELECTRIC FURNACE that melts 60 lbs. of metal and is useful for investment casting is subject of literature from Detroit Electric.

86. JOB STUDY BROCHURE shows analysis of pieces cast in plaster molds by Ohio Precision.

87. DIE CASTING PLANT, equipment and personnel of Republic Die Casting are presented in illustrated brochure.

89. HOW TO HEAT WAX for investment casting patterns explained in literature from Sta-Warm Electric.

92. HIGH SPEED TAPPING heads are described in literature from Procunier Safety Chuck Co.

95. TOOLS FOR DIE WORK and a regrinding service are in "All Star" catalog from Severance Tool Industries.

...and now

Metal Hydrides INCORPORATED

12-34 CONGRESS STREET BEVERLY, MASS.

Chrome-Nickel Alloy Powder — 800 A Sup

Supplemental data on **Custom Alloy Powders** for **Alloy Steel Compositions*** ...high tensile strength

*50% Chromium—50% Nickel Alloy powder combined with 1% Graphite and electrolytic iron powder.

Tensile strength psi 121,000

(Sintered 2 hrs. at 1200°C.)

Sintered density	6.97
Elongation % in 1"	2.5
Rockwell Hardness	B-99

Multiple advantages accrue to you through the use of MH Chrome Nickel alloy powders for Alloy Steel compositions in your powder metallurgy molding —

- volume production of intricate parts, having higher tensile strength
- miniaturization of parts with greater strength and less mass
- no scrap or waste, no milling or finishing required

Fine particle size is an outstanding feature of MH Chrome Nickel alloy powders, as indicated on the chart below.

COMPARISON OF EFFECTS OF HEAT TREATMENT ON PROPERTIES OF ELECTROLYTIC IRON POWDER PLUS ALLOYS OF VARIED NICKEL—CHROMIUM CONTENTS

Compacting Pressure — 50 Tsi
Sintering Condition — 1100° C for 1 hour at temperature in hydrogen

MATERIAL	Electrolytic Iron + 1% Graphite + 10% Alloy (80% Ni — 20% Cr) TENSILE STRENGTH PSI	ELONGATION %IN 1"	ROCKWELL HARDNESS	SINTERED DENSITY G/CC	Electrolytic Iron + 1% Graphite + 10% Alloy (80% Cr — 20% Ni) TENSILE STRENGTH PSI	ELONGATION %IN 1"	ROCKWELL HARDNESS	SINTERED DENSITY G/CC
Sintered	72200	2.5	Rs83	7.11	66100	2.0	Rs99	6.64
Coined	76300	4.6	Rs85	7.18	63000	2.0	Rs95	6.65
Coined & Annealed	71000	3.5	Rs84	7.15	83000	2.0	Rs95	6.65
Coined & Quenched	76900	1.7	R:25	7.08	84400	2.0	Rs100	6.65
Coined, Quenched & Annealed	99500	0.5	R:15	7.08	92900	2.0	Rs90	6.65
Quenched	75800	2.3	R:19	7.11	84000	2.0	Rs97	6.65
Quenched & Annealed	88650	2.3	R:16	7.13	77300	2.0	Rs95	6.65

SIZE CHARACTERISTICS

(80% Ni — 20% Cr)		(80% Cr — 20% Ni)		(50% Cr — 50% Ni)	
+ 100	2.4%	— 100 + 200	4.7	+ 100 mesh	0.8%
— 100 + 200	31.9%	— 200 + 325	9.7	— 100 + 150	4.5
— 200 + 325	28.5%	— 325	85.6	— 150 + 200	8.9
— 325	37.2%			— 200 + 270	11.0
				— 270 + 325	12.2
				— 325	62.6
				Apparent Density g/cc By Scott Volumeter	1.89

For detailed information, write:

MH METAL HYDRIDES INC

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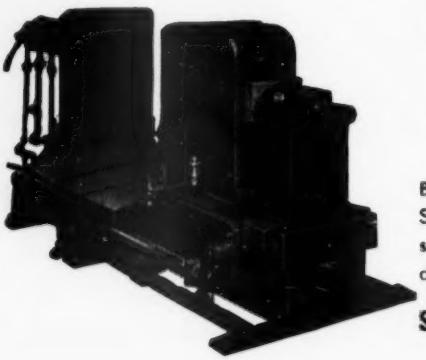
INDUSTRIAL HEATING AWARD GOES TO FOUR

The Trinks Industrial Heating Award, the nation's top honor for the industrial heating and related fields, was presented recently to four engineers, all industrial executives.

The four honored were Harry H. Harris, president, General Alloys Co., Boston, Mass.; Carl I. Hayes, president, C. I. Hayes, Inc., Providence, R. I.; Carl F. Mayer, president, The Carl Mayer Corp., Cleveland O.; and J. Spotts McDowell, technical assistant to the president, Harbison-Walker Refractories Co., Pittsburgh, Pa.

The Award is bestowed annually by a judges' panel, among candidates nominated by the industry, for the most notable contributions to economic or scientific progress in industrial heating.

For additional information Circle No. 96 on the Reader Service Card



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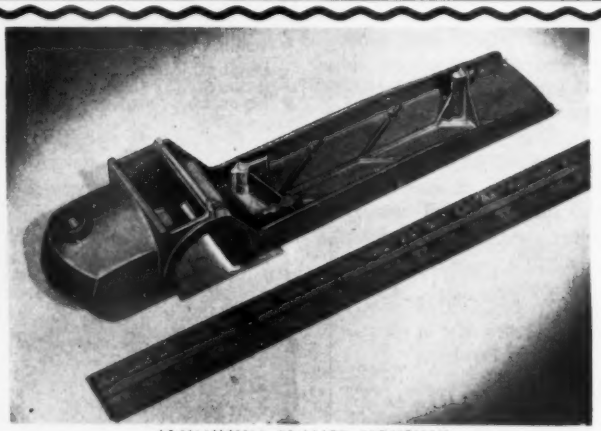
Grand Rapids 4, Michigan



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OPPORTUNITIES

Metropolitan New York sales agency covering metropolitan New York, New Jersey & Philadelphia, desires reputable die castings account. No conflicting lines. Established 15 years. Write Box No. 6153, Precision Metal Molding magazine.

Detroit electric rocking furnace type GM Serial 1038 capacity 35 lbs. now in operation. American Precision Casting Corp., 7711 Lyndon St., Detroit 21, Mich.

TECHNICAL SALES REPRESENTATIVE: Aggressive new organization headed by man with 25 years of sales and production engineering experience, offers active selling and technical help to a die casting and a powdered metal parts producer. Covering manufacturers in the electronic and metalworking industries from New Jersey to Washington, D. C.; Write Box No. 6253, Precision Metal Molding magazine.

AJAX PLANT VISITED

Ajax Engineering Corp., of Trenton, N.J. was host recently to the Austrian Electrical Heating Industry Team, a group of engineers from Vienna who are visiting various industrial plants in this country under the auspices of the Mutual Security Agency of the United States government.

PREDICTS 16-FOLD GROWTH IN USE OF RESINS FOR SHELL MOLDING

To meet the demands for phenolic resins for shell molding and laminating applications, Monsanto Chemical Company has announced its third expansion of this line in less than a year.

Robert K. Mueller, general manager of the company's Plastics Division, reported the expansion would add about 15 percent capacity to the division's operations at Port Plastics, Ohio, and Springfield, Mass. The announcement was made coincident with the 57th annual meeting of the American Foundrymen's Society in Chicago.

Installation of a third production line at Port Plastics and higher capacity equipment at Springfield will begin immediately, Mueller said. Production began at the Ohio location last fall and capacity was expanded as recently as January, he added.

Expansion of Monsanto's capacity is based on more than one growth factor in the consuming industries, Mueller explained. Two of the potential leaders, he believed, are shell molding and laminating.

According to Mueller, acceptance of phenolic resins for shell molding in the foundry industry has been "the most recent hypodermic" in the phenolic field. He pointed out that by 1952, this application had climbed to several million pounds annually. Further, he predicted a 16-fold increase by 1958.

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ASTM STANDARDS ON LIGHT METALS AND ALLOYS; American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.; 216 pgs; $3.00 each in heavy paper cover.

This special compilation of ASTM Standards on light metals and alloys gives numerous specifications and tests issued by the organization through March 1953.

Covered are the die casting alloys, with sections on aluminum and magnesium and a separate section on magnesium and aluminum base alloys in ingot form for sand, die and permanent mold casting.

Also of special interest are specifications for aluminum permanent mold castings, and a section on preparation of aluminum alloys for plating.

Specifications for wrought products for electrical purposes include those for bars, various types of conductors, wire, etc.; also a test for resistivity. There are seven general test methods covering these light alloys, which include dielectric strength, weight of coating, measuring of thickness, tension testing and sampling.

NEW PLANT FOR CIRCO

Topper Equipment Co., has recently completed and moved into a new manufacturing plant at Rahway, N. J. The 40,000 square foot new building was constructed especially for Topper's requirements in the manufacture of CIRCO metal cleaning equipment.

STEEL INSERT
continued from page 35

pins is shown. The core, as can be seen, is made up of three pieces of low carbon steel strap ¼" x ¾". This strip material is cut to length, punched and then three formed pieces spot welded together. This fabricated core is delivered to the die caster who uses it as an insert in the die cast pin.

These die cast pins have the required physical strength and resist corrosion in severe industrial atmopsheres. They are somewhat lighter in weight than the steel pin and since no finish machining is required, are less expensive than the older type.

In spite of the great difference in coefficients of expansion between steel and aluminum, a permanent bond is secured that holds under all normal changes in ambient temperature. The use of a die cast pin has further allowed making the bullet nose sharper to make assembly faster. It represents a large saving of metal previously machined away to form the taper of the conical end.

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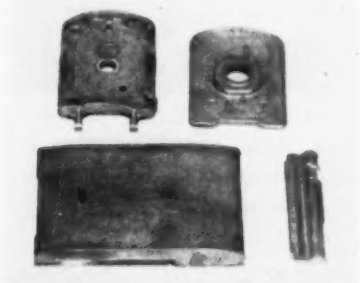
RIGID STRUCTURE
continued from page 50

time provides the kind of accuracy necessary.

The camera lens is made up of three separate glass elements, two of which are carried by the front housing and one by the rear. Since these must be held to very close tolerances for eccentricity and alignment with each other, the front and back housing castings are paired on a fixture which locates from the lens mounting surfaces. The two



4. BOSSES and spring mounts are integral parts of the shutter housing die castings.

parts are then doweled together and kept as a pair.

Since the entire body of the camera is covered with a plastic cover or some similar decorative material, a simple anodizing treatment after all minor machining and trimming is adequate.

SMALL DIE CASTINGS
continued from page 39

or cheaper by die casting. Consultation with a die casting producer can help in deciding whether the part would be practical as a die casting.

Some features of small zinc die castings

The group of examples presented on these pages illustrate the principal advantages

continued next page

The Haller
OIL WELL PRINCIPLE

Now Being Applied To
POWDERED METAL PARTS LIKE THESE

Various types of bearings, bushings, gears, wear plates, machine gibs and other powdered metal parts now incorporate the Haller Oil Well feature.

Originally introduced in bearings, the forming of cavities or "pockets" in the center of powdered metal parts has proved to be a highly successful method of increasing oil content. In such parts, as oil or grease is impregnated into the sintered metal by static pressure, it fills the cavities as well as the pores in the sintered metal body itself. The result is a greatly increased lubricating quality which permits the parts to take heavier loads in their particular applications.

With the many new possibilities for adaptation of this design principle to a wide variety of parts, it can be to your advantage to investigate how it can be applied to your present or future products. The one limiting factor to be considered at the present time is that "oil well" parts are being produced in high volume on a contract basis only. We invite your inquiries.

Write for this bulletin describing our facilities and the scope of our powdered metal parts production.

MICHIGAN POWDERED METAL PRODUCTS COMPANY, INC.

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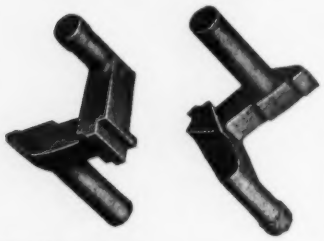
Forgings Replaced

WITH Epco

INVESTMENT CASTINGS



Castings pass 100% X-ray inspection. Material: Alloy Steel AISI 8620

THE ILLUSTRATION SHOWS A PAIR OF LEVERS USED IN A HIGH-SPEED GUN BREECH MECHANISM

THESE PARTS WERE PREVIOUSLY MACHINED FROM SAE 1020 FORGINGS. A CONSIDERABLE SAVING IN COST WAS REALIZED BY USING AN EPCO INVESTMENT CASTING

SEND US YOUR DRAWINGS FOR QUOTATION ON PARTS WHERE ***EXTRA QUALITY*** MUST BE MAINTAINED

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FREEHOLD ROAD
MATAWAN, N. J.

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izations are worth considering.

Zinc alloy is easy to finish by standard commercial processes now available. One of the most economical ways to finish such small pieces is barrel tumbling. Pieces can be deburred, polished, colored or burnished by this process.

Almost all commercial finishes are suitable: plating, painting, chemical dips or black oxide finishes. In the majority of cases, they can be applied by bulk processing methods for lowest unit cost.

Zinc alloy has some special attributes, too, which should be utilized by the designer. Zinc can be cold formed very easily. This means that hollow bosses can be cast and riveted over in assembly.

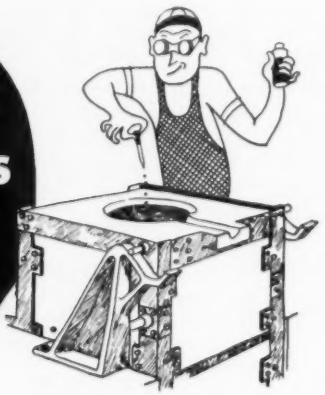
Zinc is easily machinable, comes from the die with a smooth surface, and has moderate strength characteristics.

Tolerances can be held quite closely, if desired, although naturally, the closer the tolerance, the higher the cost. The use of a single cavity die is frequently resorted to when dimensions must be exceptionally close, although it is entirely practical to produce from multiple cavity dies to boost production rates when dimensions are more open.

A few of the multitude of uses for small zinc die castings are suggested here. These are examples from current production. They are being used in razors, toy components, electrical fittings, clocks, automatic pencils, business machines, zippers.

Also, locks, domestic hardware, name plates, portable tools, dolls, ordnance components, household appliances, coin machines, textile findings, small mechanisms, etc.

MASTERMET'S minor **ELEMENTS** make **MAJOR DIFFERENCES**



It costs little more to investment cast alloy steels than carbon steels. With alloy steels you give your customers important PLUS VALUES in corrosion and wear resistance.

Cannon-Muskegon's MASTERMET is a master melting stock built to all standard (or your special) specifications, whether it be for tool steel, stainless, super stainless or cobalt and nickel base alloys containing only a trace of iron. Available in SHOT or INGOT form for best melting in YOUR equipment.

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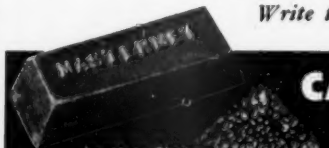

CANNON-MUSKEGON

MUSKEGON, MICHIGAN

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SIMPLIFIED SOLUTIONS

for production problems

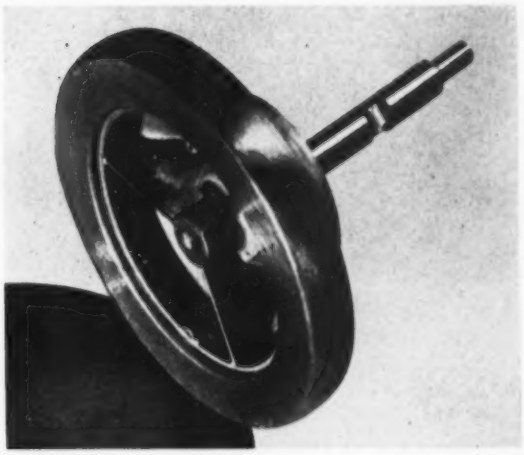
ZERO DRAFT on the vanes of this super-charger diffuser is one important requirement which affects the choice of production methods. Smoother than usual surfaces and ±.010 tolerances on the air flow passages are other requirements.

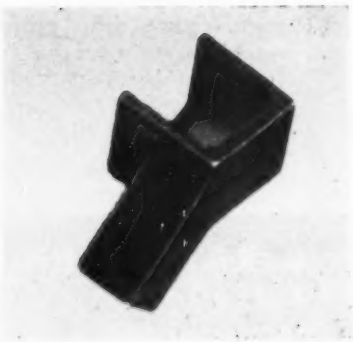
Machining from solid stock is economically prohibitive; assembly of preformed vanes on a plate would lack accuracy and smooth flow characteristics; machined forgings or sand castings would be too expensive.

The solution is an aluminum casting by the Antioch process by Morris Bean Co. As cast, the diffuser is held within required tolerances, and important surfaces have a finish better than 125 micro inches. The casting is in ASTM aluminum alloy 51 A, is 24¾ inches in diameter, and weighs 16 pounds.

FOR MANUFACTURING ECONOMY, it was desirable to cast the shaft of this handwheel as an insert in the zinc die casting. In the casting operation when the machine was opened there was invariably a sufficient shift in alignment of the two halves of the die so that the shaft would bind in the hole in the die block. As might be expected, this resulted in severe galling of the shaft; particularly was this true close to the handwheel where it was essentially impossible to remove the gall marks by grinding.

The solution of this trouble was found in electrolyzing the shaft prior to casting. By this process, a very thin film of an extremely hard tungsten alloy was applied to the shaft. This hard surface effectively prevents galling, but is sufficiently thin so that subsequent machining can be done on the shaft. There is, incidentally, no evidence that tool life is appreciably shortened due to the presence of the hard surface.





IF A LENS OR PRISM in precision optical equipment is ground within tolerances of millionths, the mounting of such an element requires accuracy of a high order. No casting method can give pieces accurate enough for this, but the investment casting process gives such a high degree of precision that finishing is minimized.

This mounting piece shown at the left holds a prism for an optical instrument manufactured by Instrument Development Laboratories of Needham, Mass. It is investment cast in aluminum by the Rode Company.

On a small part such as this, dimensional variations can be limited to less than 0.001, but more important is the high degree of over-all uniformity and reproducibility. Thus, it is possible to set up fully automatic machines to do most or all finishing.

For Your Ferrous Casting Needs Get These...

4 Freedoms

Freedom from...

1 Porosity
2 High Cost Material
3 Expensive Machining
4 Metallurgical Variation

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PERMANENT MOLD Gray Iron Castings

Permanent Mold Gray Iron Castings by DOSTAL offer many advantages. Their structure is uniform and surface scale is eliminated. These 2 factors permit higher speed machining with faster feeds. The dimensional accuracy and uniformity of DOSTAL Permanent Mold Castings reduces machining operations to a minimum. Permanent molded castings are uniform in hardness and their structure is dense and porous-free.

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FOUNDRY and MACHINE COMPANY
2504 Williams Drive
Box 180 Pontiac, Mich.

For additional information Circle No. 71

ALUMINUM FINISHES
continued from page 67

preparation of the surface prior to the spray dip or brush application of the coating materials. In order to obtain adequate adhesion of the enamel or lacquer coating, it is not necessary to roughen the surface by sand or grit blasting. A roughened surface will key the enamel or lacquer coating to the surface, but the same degree of adhesion is possible by proper chemical conditioning of a smooth surface. The smooth surface has many advantages, with appearance being the most important. Satisfactory adhesion is possible by proper conditioning of the surface. First, the surface must be free from oil or grease so that conditioning treatments will react uniformly on the surface. Some of the proprietary treatments have greater tolerances for grease or oil films, but it still is good general practice to have the surface cleaned by vapor degreasing, solvent degreasing or solvent emulsion degreasing. Generally, the selection of the surface conditioning treatment depends upon the severity of the exposure conditions of the application.

For applications involving only mild exposure, a simple treatment such as etching in phosphoric or chromic acid solutions are sufficient. Frequently, these solutions are used hot and the immersion time is about 5 minutes. Chromic acid solutions are generally used at about 10% concentartaion, whereas the phosphoric acid solutions are usually employed at concentrations varying from 10 to 20%. Adequate rinsing in fresh running water is recommend-

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Time-tested Ransom & Randolph Investments can save you time and money in the production of consistently accurate castings. They are backed by nearly half a century of leadership in the manufacture of dental casting investments, and more than twelve years of experience in producing investments for casting all low- and high-melting alloys used in the industrial field.

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ed, followed by drying in a warm air blast. A final dip in hot water slightly acidulated with chromic acid is sometimes used as the last operation in the process based upon etching in phosphoric acid solutions. There are a variety of proprietary phosphoric acid type conditioning compounds commercially available. Many of them contain butyl alcohol, isopropyl alcohol or other organic grease solvents and various wetting agents and emulsifying agents to make them more efficient if residual films of oil or grease are present on the surface.

HOUSEHOLD APPLIANCE components, such as this control box for the Speed Queen automatic washer, are frequently aluminum die castings with baked enamel finish.

Alkaline chemical treatments are excellent preparatory treatments for lacquers and enamels. Several proprietary chemical treatments of the acid type are available which also produce films on the surface that promote adhesion of the enamel and lacquer coatings besides having good inherent resistance to corrosion. If the enamel or lacquer coating is ruptured, the corrosion resisting properties of the surface film are important as they will prevent peeling of the coating.

For applications involving severe exposure conditions, anodic coatings are sometimes used. These coatings are produced either in sulphuric or chromic acid electrolytes on wrought products; however, because of the difficulties sometimes encountered in applying chromic acid anodic films to die castings, the Alumilite 710 coating, applied in a

continued next page

VELVAGLAZE

MONARCH VELVAGLAZED DIE CASTINGS USED ON THE GENERAL ELECTRIC CANNISTER CLEANER

Cuts Finishing Costs...

AND IMPROVES PRODUCT QUALITY

Velvaglaze is now used by leading manufacturers to obtain a more durable, brighter surface finish that improves product sales appeal. Velvaglaze resists scratching and marring experienced on normal cast aluminum surfaces.

Velvaglaze is available exclusively on Monarch aluminum Permanent Mold castings and aluminum Die Castings. Investigate the substantial savings you can obtain over other comparable fine finishing methods using Monarch Velvaglaze castings.

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"Here's How You Can Cut Die Casting Finishing Costs"

Monarch ALUMINUM DIE CASTING COMPANY

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- Aluminum Die Castings
- Certified Zinc Die Castings
- Complete Product Assembly
- Every Modern Finishing Service

Detroit Ave. at W. 93rd St., Cleveland 2, Ohio

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Here's the widest range of Metal Powders to meet an even wider list of uses!

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3. SOLDER
4. PYROTECHNICS
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8. ELECTRODES
9. FILTER PARTS
10. MOTOR BRUSHES

At MD, a user finds a complete line of Metal Powders—to meet an even wider group of varied and greatly diversified uses, some of which are illustrated here.

Here, in addition, the Metal Powder user finds the extensive MD laboratories and their constant research dating all the way from 1916 into *tomorrow!* Here are the plants devoted to the manufacture of Metal Powders in greater quantity than anywhere else.

That's why it pays to take your Powder Metallurgy problem direct to Metal Powder Headquarters. Save time as well as costs—one call to MD does it all!

For thoroughly experienced advice and recommendations consult the MD Sales Service Department.

METAL POWDERS
METAL PIGMENTS
METAL ABRASIVES
Since 1916

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Elizabeth B, New Jersey
Plants: Elizabeth, N. J., Manchester, N. H., Berkeley, Calif., Emeryville, Calif.
SUBSIDIARY OF AMERICAN-MARIETTA COMPANY
2542

ORIGINATOR AND OLDEST PRODUCER OF ALUMINUM PASTE

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sulphuric acid electrolyte and dichromate sealed, is recommended for best results, For many applications, particularly those involving die castings as component parts of instruments, cameras and optical articles, the Alumilite Black finish has given excellent results. This black finish is an excellent base for the black enamels generally used for this applications and has the additional advantage of a black, non-reflecting surface if the enamel is abraded or chipped from the surface.

After employing any of the above treatments, the surface of the die casting should be thoroughly dried by heating before any paint coating is applied. This is particularly important if baked coatings are to be employed since failure to do so may result in paint blistering. Heating the casting for one half hour at 225 F should be sufficient to drive out moisture retained in pores.

Many applications involving aluminum die castings involve extremely severe exposure conditions, and it is necessary to employ enamel or lacquer systems incorporating primers over the chemical or anodic films prior to the application of the enamel. The general practice is to use primers based upon zinc chromate pigments. Primers containing lead pigments are not recommended, as there is danger of galvanic corrosion occuring if the primer coating is exposed by failure of the enamel or lacquer coating.

Vitreous enameling as a finishing system for aluminum alloy die castings has not been too successful, because the 950 F. firing temperature required produces blisters on the surface of the casting. The enamels seem to have good adhesion to the surface but the high firing temperature of the vitreous enamels presently used in commercial production

on wrought aluminum products seem to be too high for successful applications to aluminum die castings.

Aluminum alloy die castings finished with one of the available finishing systems are the logical choice for many commercial applications. These finishing systems, which are used to change the appearance, increase the resistance to abrasion or improve the resistance to corrosion, make aluminum alloy die castings an even more versatile product for a host of applications.

ANNOUNCE NEW MAGNESIUM DIE CASTING ALLOY

The Dow Chemical Company has announced the availability of a new magnesium alloy ingot patterned to the needs of the commercial magnesium die casting industry. This alloy, designated as Dowmetal AZ91B, contains beryllium additions for lower melt loss and increased efficiency.

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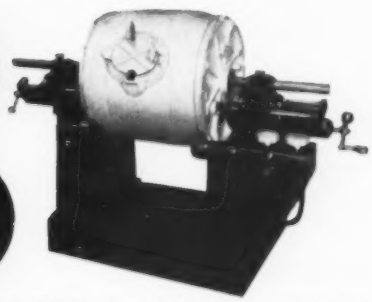

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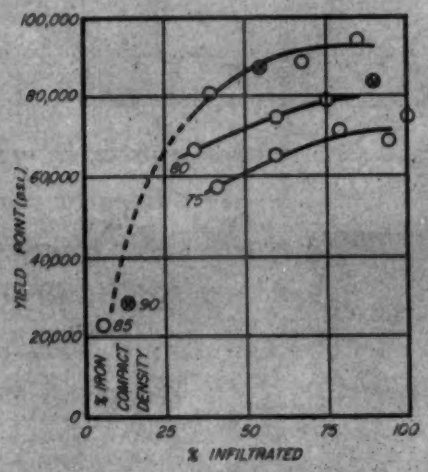
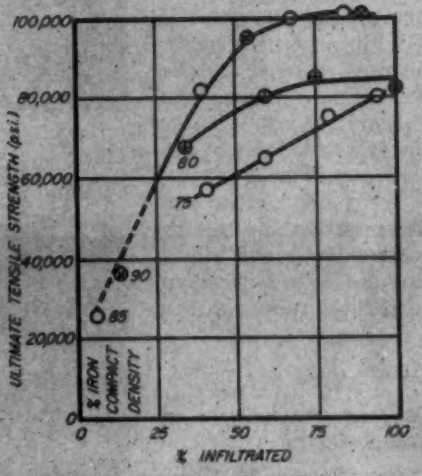


Effect Of Degree Of Infiltration On Yield Point

1a. Ultimate tensile strength vs percentage infiltrated.



Effect Of Degree Of Infiltration On Tensile Strength

1b. Yield point vs percent infiltrated.

THE EFFECT OF INFILTRATION on physical properties of sinterings

By GEORGE STERN*

It would be difficult to do justice to this entire field of infiltrated alloys in a single article. Therefore, this review shall consider the field of iron and steel skeletons infiltrated with copper base alloys. The theory, practice and economic factors are considered for this single category of ferrous skeletons and copper base infiltrants. The variables affecting infiltration, such as composition of the skeleton, composition of the infiltrant, effect of time and temperature of infiltration and effects of subsequent heat treatments, are also dealt with at some length.

INFILTRATION techniques have been used for a great number of years to fabricate bodies with unusual properties which cannot be achieved by the conventional casting and subsequent working techniques. Infiltration is usually applied to combine relatively refractory skeletons with lower melting infiltrant alloys for the achievement of these unusual properties.

Table 1 lists some typical applications for infiltration techniques and indicates the skeleton composition, the infiltrant composition, the intended application and the temperature range for use of the infiltrated composition.

What is infiltration?

Infiltration is a term broadly applied to the case where one liquid metal or alloy of a relatively lower melting point is caused to come in contact with a second solid porous metal or alloy of a higher melting point, and to penetrate the interconnecting porosity partially, or fully. The higher melting point remains in the solid state throughout the infiltration period, and diffusion between the two systems may or may not occur.

One requirement for successful infiltration is that the solubility of the solid skeleton in the low melting material be limited, so that distortion of the geometric shape of the skeleton is minimized. In the case of an iron skeleton and a copper infiltrant, at infiltration temperature, approximately 8 percent of the iron is soluble in the molten copper infiltrant. No strict criteria can be set up for other systems, but it would appear that this solubility of solid skeleton in liquid infiltrant should not exceed approximately 10 percent.

The infiltration period is followed by a solidification of the lower melting material on cooling. The infiltrated body may then be subjected to various heat treatments, press operations, and/or special surface treatments for final corrosion or oxidation resistance properties of the thus prepared body.

Why is it done?

Infiltration of iron or steel skeletons with copper-base alloys is performed to improve the physical properties of the iron or steel skeletons without resorting to several sinterings and several high pressure pressing operations. Residual pores in an iron or steel sintering are responsible for lowering of the yield point and tensile strength and especially of the elongation, reduction in area, impact and fatigue properties.

While these pores can be decreased by several alternate pressings or coinings with intermediate sinterings at high temperatures, such procedures are usually prohibitive, especially where maximum physicals are desired.

Infiltration of a reasonably dense iron or steel skeleton with copper-base alloys can accomplish in one infiltration operation an improvement in physical properties far beyond the improvement that could be obtained with as many as two additional coining and sinterings. Furthermore, infiltration of a pure iron skeleton pressed at about 25 t.s.i. with a properly selected copper alloy infiltrant can result in properties equivalent to those of a medium carbon steel body, produced by pressing at 60 t.s.i. sintering for one hour at 2100F., repressing at 60 t.s.i., and resintering for one hour at 2100 F.

There also exists in infiltrated parts an equalization of properties despite varying skeleton densities which can be called the "flywheel" or compensating effect. If a complicated shape is to be made by

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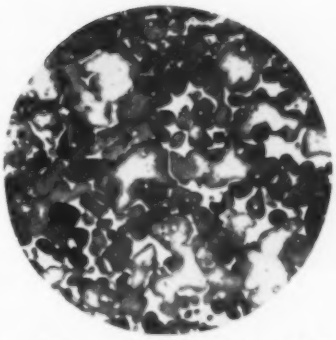
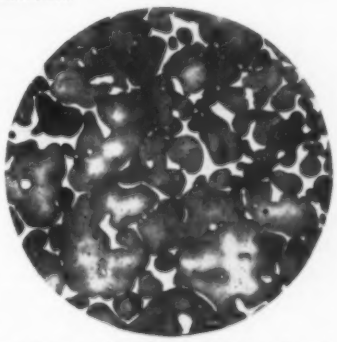
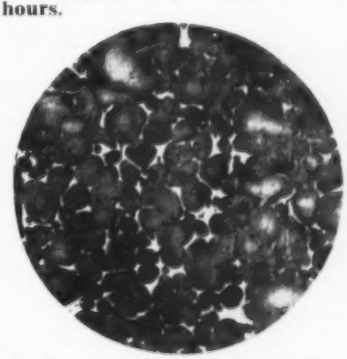


2. Iron skeletons, 85% dense, infiltrated at 2125F for 15 minutes.



3. Iron skeletons, 85% dense, infiltrated at 2125F for 2 hours.



4. Iron skeletons, 85% dense, infiltrated at 2125F for 4 hours.

5. Iron skeletons, 85% dense, infiltrated at 2125F for 110 hours.

*Vice President — Technical Director; American Electro Metal Corporation

Some physical properties & applications of infiltration:

TABLE 1
Applications for Infiltration Technique

Skeleton Composition	Infiltrant Composition	Application	Temp. Range in Use
W, Mo, WC, Mo_2 C	Cu, Ag, Cu-Ni	Electrical Contacts Heavy Metal	Room Temp.
Graphite	Cu, Cu Base Alloys	Bearings, Brushes	Room Temp.
Fe, Fe-C	Cu Base Alloys	Jet Engine Compressor Blades Structural Parts	300-700°F Room Temp.
	Pb	Bearings	Room Temp.
Ti C Ti C-Mo_2 C	Ni Cr Co-Cr Ni-Co-Cr Stellite Inconel etc.	Nozzle Deflection Vanes Jet Engine Buckets Valve Seats Valve Guides Heat Resistant Alloys Generally	1100-1800°F

molding metal powders, uniform density is difficult to achieve in all portions of the body. Even after sintering and coining, this variation in density will persist.

Now if infiltration is performed, with sufficient quantity of infiltrant, two conditions can occur, depending upon the time and temperature of infiltration:

- All portions of the body can be completely infiltrated despite varying skeleton densities.
- Only the sections having large amount of interconnected pores will be completely infiltrated, while the more dense sections will be incompletely infiltrated. It is assumed here that the time of infil-

TABLE 2
Physical Properties for Various Skeleton & Infiltrant Compositions

	As Infiltrated		Ppt Hardening	
	15 Min.	2 Hrs.	15 Min.	2 Hrs.
Fe-Cu				
Yield	51,200	71,200	72,200	80,900
Tensile	60,400	75,900	79,900	88,100
% Elong.	11	4.7	3.7	2.7
% R. A.	11.6	4.28	4.1	3.3
RHB (Range)	80.5	95	87.5	96
Fe-Cu-Mn				
Yield	76,500	87,700	80,000	87,200
Tensile	84,100	89,200	93,000	95,500
% Elong.	2	1	2.6	1.3
% R. A.	2.9	.82	2.7	1.3
RHB (Range)	87.5	94	92.5	89
Fe-Cu-C				
Yield	68,500	71,800	78,300	86,500
Tensile	75,500	78,800	83,500	90,500
% Elong.	4	2.3	4	2
% R. A.	4.5	1.6	4.0	2.4
RHB (Range)	91.5	95.5	97	93.5
Fe Cu-C-Mn				
Yield	73,500	91,100	92,800	89,200
Tensile	82,700	93,400	93,800	92,200
% Elong.	1.3	1	1.3	2
% R. A.	1.08	.82	.82	1.63
RHB (Range)	97.5	94	96	96.5

tration is too short to permit complete penetration of the infiltrant along grain boundaries to isolated pores.

Figures 1A and 1B show the ultimate tensile strength and yield point plotted vs. percent infiltrated for iron skeletons of varying densities, infiltrated partially or completely with a copper alloy. All properties are for the bodies after infiltration, solution heat treatment and precipitation hardening.

If all portions of the complex body are completely infiltrated the 75 percent dense section will have an ultimate tensile strength of 81,000 p.s.i. and the 90 percent dense section will have 102,000 p.s.i. Thus, by designing the body for the low strength value, safety can be assured.

Now if the second condition prevails and incomplete infiltration occurs in the 90% dense section, and complete in

continued next page

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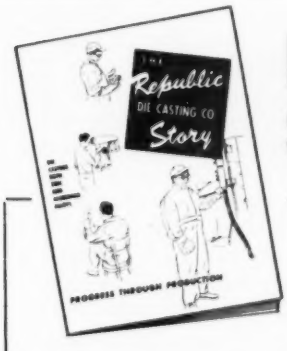

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the 75 percent dense section, safety is still assured by having 81,000 p.s.i. in the 75 percent dense section. Furthermore, since at lease some infiltration will occur in the 90 percent dense section (assume at least 40 percent infiltrated), this section will also have 81,000 p.s.i. ultimate tensile strength.

This effect in infiltrated bodies permits the fabrication of complicated shapes with assurance of good physicals, despite density variations in the as coined condition.

Effect of variables on properties

Now that the general aspects of infiltration have been discussed it might be well to consider some specific experiments and variables.

In order to study the effect of skeleton density, skeleton composition, infiltration time, and subsequent heat treatment, a series of experiments was run. The conditions for these experiments were as follows:

1. Electrolytic iron powder was used exclusively for the skeleton. (It should be pointed out here that in practice various commercial, reduced iron powders can be used with excellent results achieved. However, since this was a controlled experiment, a pure known material was selected.)
2. Skeleton bars were prepared by pressing, sintering at 2100F. for one hour, and coining to 85 percent density.
3. The infiltrant consisted of either an alloy of copper and iron or an alloy of copper, iron and manganese. These alloys were made by atomization of a liquid alloy of the desired composition. (In practice prealloyed powders are preferred and can be made by atomization or by pressing mixtures of elemental powders which are subsequently diffusion heat treated for complete alloying prior to infiltration.)
4. Where carbon was specified in the system, it was added by mixing 0.25 percent graphite with the electrolytic iron powder prior to pressing. This resulted in carbon content of approximately 0.15 percent in the final sintered body.
5. Infiltration was in all cases conducted at a temperature of 2125F. for the time specified.
6. Following infiltration, all bars were solution

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heat treated for one hour at 1600F. followed by oil quenching.

7. Following solution heat treatment, all bars were precipitation hardened by heating to 932F. for one hour.

The results obtained from this study are shown in Table 1, where yield point, tensile strength, percent elongation in one inch, percent reduction in area and hardness are listed for the different systems investigated in the "as infiltrated", and in the heat treated condition.

It can be seen from Table 2 that while 15 minutes of infiltration is insufficient to develop maximum properties, two hours at infiltration temperature seems to develop much higher physical properties. It can be further seen that the systems free of carbon, namely the iron-copper and the iron-copper-manganese, benefit most from the heat treatment provided.

Where carbon is present, the precipitation hardening is less effective, since the carbon in the steel skeleton has caused hardening due to the quenching treatment from 1600F. This is further modified by the treatment at 932F. which is, in effect, a tempering. Therefore where carbon is present to an appreciable extent, other heat treatments would be more beneficial if maximum physical properties are desired.

From Table 2 it can further be seen that by providing manganese to the system through the infiltration, better physical properties can be obtained for the carbon-free system.

The effect of infiltration time can best be studied by a series of photomicrographs.

continued next page

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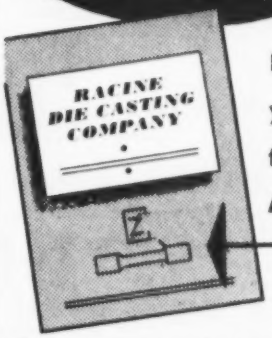

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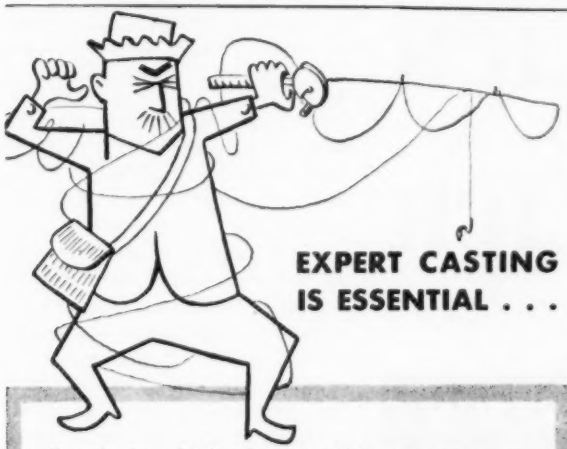

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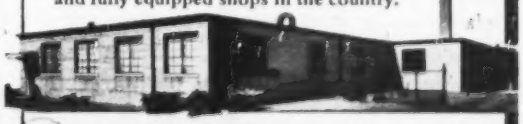

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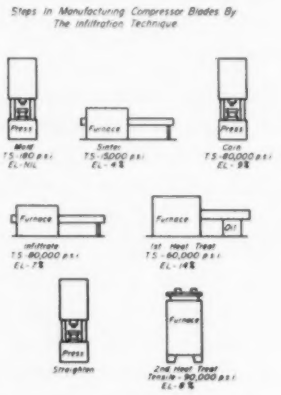
85 percent dense iron skeleton with an infiltrant containing iron and manganese at a temperature of 2125F. and 15 minutes at infiltration temperature. The distribution of grain size is quite non-uniform, and a coring is visible in a large number of grains, indicating incomplete and non-uniform diffusion of copper into iron.

After two hours, Figure 2, the grains have grown somewhat, with the coring still visible, and the grains more or



5. Steps in manufacturing compressor blades by infiltration techniques.

less disconnected, due to penetration of the infiltrant. After four hours, Figure 4, at infiltration temperature, coring has practically disappeared, and the grains have become rounded and more uniform in size.

Figure 5 shows the structure obtained after 110 hours at infiltration temperature, where coring has disappeared and the grains are well rounded with no smaller grains remaining. All grains are closely of the same size. The copper is now distributed in a fine network. It should, however, be pointed out that such an ideal structure does not provide the best physical properties as it is quite brittle.

Advantages of the Infiltration Process

The practical advantages of the infiltration process can best be cited by choosing a

specific example. Some years ago, the American Electro Metal Corporation developed a process for the manufacture of compressor blades, using copper-infiltrated iron, which was later placed in production by the Thompson Products organization. The actual steps in this process are illustrated in Figure. 5 which is a schematic representation of the process. The blades were first molded using commercial iron powder and at a pressure of approximately 25 tsi. This was followed by a sintering and a coining operation. By using straight iron powder, the coining was readily accomplished, and the blades were produced with the necessary contour and the thin trailing edge. The coined blades were then infiltrated, which was followed by a solution heat treatment in order to render the blades soft for a subsequent press straightening operation. This was followed by a final precipitation hardening treatment at the end of which the blades had the physicals indicated, namely an ultimate tensile of approximately 90,000 psi and an elongation of approximately 8%. Representative blades pro-

continued next page

6. Some compressor blades made by infiltration process.

Properties of Final Blade

Dimensional Tolerances:

Width	± 0.008
Thickness of airfoil	± 0.003
Contour of airfoil	± 0.005*
Straightness of airfoil	± 0.005
Twist	± ½°

Mechanical:**

Yield Point	80,000 (65,-90,000)
Tensile Strength	90,000 (75,-100,000)
Elong., Pct.	8 (15-5)
Rockwell B Hardness	90 (82-98)
Bending angle	120° (180°-60°)

* If blade perfect on twist contour is 0.003 in.

** Physicals can be varied by varying heat treatment and raw materials when desired and figures in parenthesis indicate the range.

7 Very close dimensional tolerances have been achieved in infiltrated compressor blades, as evidenced by tabulation above.

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INFILTRATION — cont.

duced by this process are shown in Figure 6.

Not only were these blades made to the desired physicals, but the dimensional tolerances achieved were very close, as is shown in Figure 7.

The advantages obtained through this process were:

1. While the conventional compressor blade formerly used was made of Type 403 stainless steel containing 12% chromium, the powder metallurgy blade was made of iron powder, originally made from mill scale, a steel mill by-product, and copper, to the extent of approximately 20%. This resulted in a considerable saving in strategic material.
2. The infiltration process eliminated the need for heavy forging equipment.

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3. Longer die life was experienced using the powder metallurgy technique. Die life 20-30 times the life of forging dies resulted. This, of course, meant a saving in man hours and in steel.

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6. The final product gave superior performance in service, especially in reregard to fatigue properties, and due to better dimensional control.

This specific example illustrates the economic, as well as technical advantages of the infiltration process in a very striking manner. It should be

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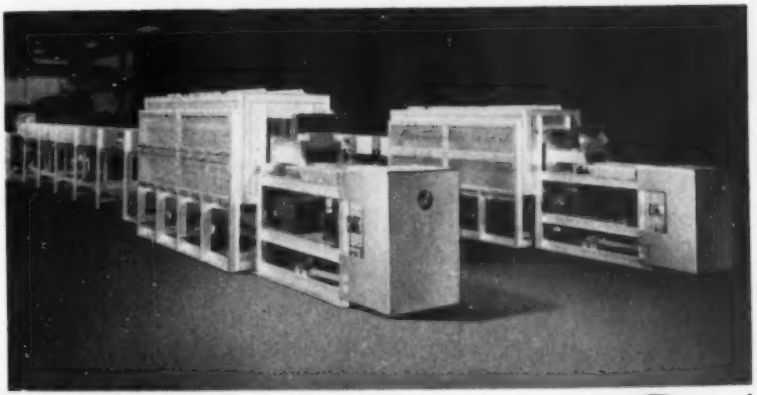

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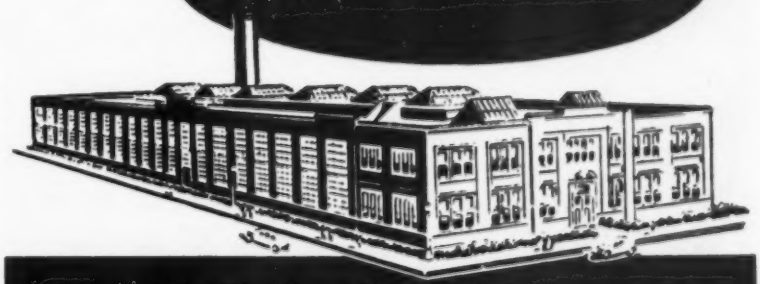

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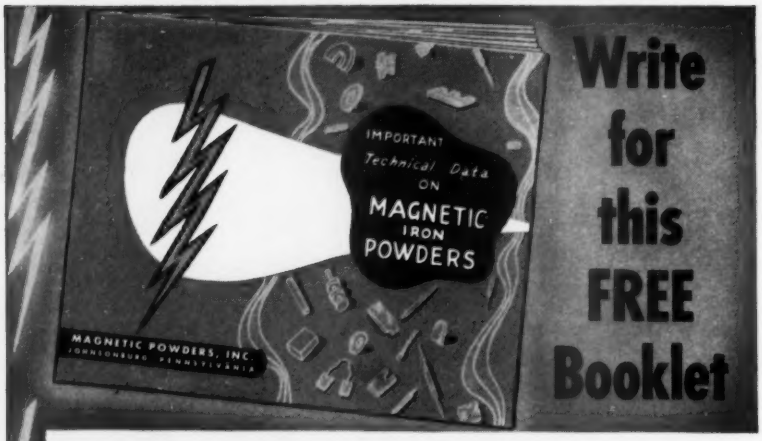

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thoroughly understood that the same conditions that resulted in this case can obtain in the case of conventional parts, such as gears, sprockets, cams, and structural parts generally.

BURNS GEORGE HONORED BY METALLURGY AWARD

Burns George, vice president in charge of sales, Vanadium-Alloys Steel Company, Latrobe, Penn., has been named recipient of the 1953 McFarland Award for Achievement in Metallurgy by the Pennsylvania State College Chapter, American Society for Metals. He was honored in ceremonies at Penn State in May.

Established in 1948 to honor outstanding metallurgical graduates of the Pennsylvania State College who have distinguished themselves in some field of metallurgy, the award is named for Dr. David Ford McFarland, chemist, geologist, metallurgist and co-discoverer of helium in natural gas.

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Can You Gain More Design Freedom with *INVESTMENT CASTING?*

The Howard Investment castings shown here illustrate how much more design freedom you gain with investment casting.

These castings are stainless steel valve parts for the air conditioning and heating system of the cockpit of *United Aircraft Corporation's Chance Vought F-7U Cutlass jet fighter*, shown above. Air conditioning is pilot protection. At high jet speeds air friction on the Cutlass' metal skin creates high cabin temperatures.

Note the intricacy of these as-cast parts. The small butterfly gate fits into the larger casting's valve port.

By designing for investment casting, *United Aircraft* engineers used less time to get the parts off drawing boards into foundry production, finishing and assembly.

Because investment casting maintains excellent metallurgical stability, these parts are more stable parts. They're capable of maintaining extremely close tolerances. Howard design engineers hold tolerances from ±0.003 to ±0.008 per inch in the as-cast state.

From this brief description, we believe you can see the advantages of designing your parts for investment casting. You gain freedom of design . . . better parts . . . and faster delivery service. We'll be glad to give you specific engineering information about your own parts. Write today.

WRITE TODAY on your business letterhead for Investment Casting by Howard—a 12-minute 16 mm. color sound film. Give date desired, an alternate date and size of group. Make film dates as far in advance as possible.

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